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Canada

R-NET

Canadian Association of Recycling Industries

RECYCLING TECHNOLOGY NEWSLETTER

VOLUME 9, ISSUE 2, MARCH 2006

This is the last issue of R-NET. For nine years *R-NET Recycling Technology Newsletter* provided up-to-date information about new technology in the field of recycling. Topics discussed included recycling of automobiles, construction and demolition products, post-consumer products, metal and electronic scrap, municipal solid waste, and mining and metal processing wastes. R-NET was created for the purpose of sharing information and ideas to help you, our readers, keep pace with the exploding tide of information on recycling technologies. It was a painful decision to end the R-NET Newsletter, but it is apparent that with the vast (and growing) amount of information available from various sources, and our limited ability in recent years to efficiently search for these sources, R-NET does not have the critical mass to continue to be an effective tool.

R-NET's association with the Canadian Association of Recycling Industries allowed us to offer insight into the issues facing companies that actually acquire recovered materials and process them into new products.

When R-NET was conceived the general public was learning about the **3 R**'s:

- Reduce - do it with less.
- Reuse - use it again, maybe for a different purpose than initially intended.
- Recycle - produce new things using post-consumer or by-product materials.

The distinction between the **3 R**'s was apparent. However, something unexpected happened in the meantime, and the word "recycling" with its green connotations started to appear in unexpected places. The evolution of the term "recycling" is the most noticeable if one scans through the definitions found by a google web search ("define: recycling"):

- "The process where recyclable materials (e.g., paper, plastic, glass, metal, aluminium, steel) are converted into new products, which are suitable to replace the same or new products made from virgin materials (e.g., waste paper into office paper and cardboard, aluminium soft drink cans into new cans, plastic bottles into plastic utensils)."
- "The processing of solid waste to reclaim material for reuse."
- "Any activity that prevents a material or a component of the material from becoming a material destined for disposal."

Thank you to all of our loyal R-NET readers. It was my pleasure to talk with you and to listen to your suggestions. I wish you continued success in all of your **3 R** industrial, commercial, and community-based endeavours.

Elizabeth Giziewicz
Editor-in-Chief
CANMET - Mineral Technology Branch

VISIT R-NET's HOME in cyberspace at **http://RNET.NRCan.gc.ca/** This bilingual web site contains current and previous issues. Bookmark this site and visit it often for interesting links and current event listings. Support for this publication is provided by "Enhanced Recycling" a component of the Government of Canada Action Plan 2000 on Climate Change, Minerals and Metals.

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Editor-in-Chief Elizabeth Giziewicz
Articles Amelia Atkin
Elizabeth Giziewicz
Alexandra Pehlken
Leonard Shaw
Research Elizabeth Giziewicz
Graphics Marilyn Harris
Layout Marilyn Harris

R-NET Advisory Board:

Leonard Shaw
Michael Clapham
V.I. Lakshmanan
Johanne Bourque
Amelia Atkin

INFORMATION

Elizabeth Giziewicz
555 Booth Street, Room 338 B
Ottawa, Ontario
Canada K1A 0G1

giziewic@nrcan.gc.ca

R-NET
Natural Resources Canada
555 Booth Street, Room 338B
Ottawa, Ontario
Canada K1A 0G1
Telephone: (613) 996-1581
Fax: (613) 996-9041

http://RNET.NRCan.gc.ca

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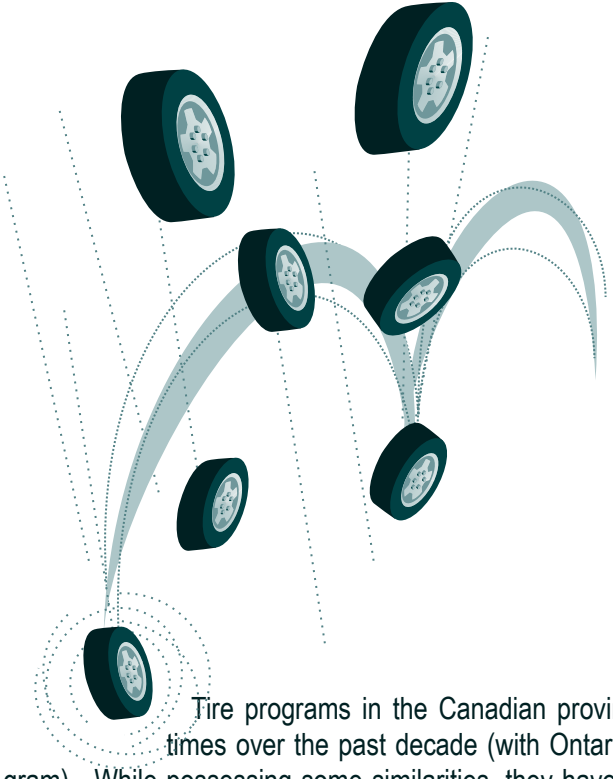

MANAGEMENT OF SCRAP TIRES IN CANADA

By Alexandra Pehlken

Tire programs in the Canadian provinces came on-line at different times over the past decade (with Ontario currently developing its program). While possessing some similarities, they have developed in various ways to accommodate their different circumstances. Some operate as a component of the provincial government, while others focus on a stewardship model, with industry stakeholders sharing responsibilities through an external Board of Directors. All tire programs have implemented a tire levy and use this levy to fund the collection and processing of scrap tires into valuable products.

Tires consist mainly of natural and synthetic rubber (up to 40 wt % combined), carbon black (28 wt %), steel, fibre, and various fillers and additives. Passenger tires contain more synthetic than natural rubber, truck tires contain more natural rubber. Off-the-road (OTR) tires (heavy mining tires, agricultural and industrial tires for large vehicles such as excavators, loaders, dumpers, tippers, compacters, compressors etc.) contain almost no synthetic rubber, as natural rubber can withstand much higher workload demands than synthetic rubber.

SCRAP TIRES PROGRAMS IN THE CANADIAN PROVINCES AND TERRITORIES

British Columbia

The Ministry of Environment, Lands and Parks initiated the Financial Incentives for Recycling Scrap Tires (FIRST) program in 1991 after the introduction of a $3 levy on the sale of every new tire. The program is funded by consumers and administered by the provincial government. There is no involvement of the tire industry, other than retailers. Financial assistance available from the program consists of a transportation credit designed to assist the movement of scrap tires from generators anywhere in the province to the nearest eligible processor registered in the program, and a processing/end use credit. More information is available at *http://www.env.gov.bc.ca/epd/epdpa/ips/tires/*

Alberta

Tire Recycling Alberta (TRA), a division of the Alberta Recycling Management Authority (ARMA) has managed the tire-recycling program since 1992. It is a not-for-profit association directly accountable to the Alberta Minister of Environment. In September 1992, an Advance Disposal Surcharge of $4 per tire was implemented,

which is used for research and development activities, collection, transportation, storage and processing of scrap tires, education programs, promotion and marketing as well as the administration of the aforementioned tire-recycling program. More information is available at *http://www.trma.com/*

Saskatchewan

The Saskatchewan Scrap Tire Corporation (SSTC) program was initiated in 1996. The SSTC is a non-governmental management agency that is comprised of stakeholders who represent the industries involved with, or affected by, the scrap tire issue. The Saskatchewan program incorporates a multi-tiered levy system, which includes passenger car tires, medium truck tires, agricultural tires and large off-road/mining tires. The predisposal levy is collected on the sale of all new tires and varies from $3.50 (passenger tires) to $50 for off-the-road (OTR) tires. Saskatchewan is the only province in Canada that has implemented a levy on OTR tires. More information is available at *http://www.scraptire.sk.ca/*

Manitoba

In 1992 under the Waste Reduction and Prevention Act (WRAP) the government of Manitoba instituted a tire levy of $3 for every new tire sold in Manitoba. The funds were fully allocated to the recycling of scrap tires under the Used Tire Management Program (UTMP). On April 1, 1995, a Tire Stewardship Regulation under the WRAP Act established the Tire Stewardship Board (TSB) as a corporation at arm's length from the government to take over the UTM Program. In 2000, the government of Manitoba "removed and retained" the P.S.T. portion of tire levy, and the board now receives $2.80 on all tires sold. More information is available at *http://mbtirebd.home.skyweb.ca/*

Ontario

Ontario was the first province in Canada to implement a scrap tire management program. In 1989 the province introduced a levy of $5 per tire, but in 1993, Ontario rescinded this program. In June 2002, the Ontario legislature passed the *Waste Diversion Act* to promote reduction, reuse and recycling of waste. This act established a multi-stakeholder board, Waste Diversion Ontario (WDO). In June 2003, Ontario Tire Stewardship (OTS) was created as a new industry funding organization. In September 2004, WDO approved the Scrap Tire Diversion Program for Ontario (developed by the OTS) and submitted the proposal the Minister of Environment for final approval. The documents can be viewed at *http://www.ene.gov.on.ca/envision/land/wda/tires/tires.htm*

Quebec

Scrap tire management was initiated in 1993. RECYC-QUÉBEC, a provincial government corporation became responsible for managing the program. In 1999 a levy of $3 per tire was legislated. For more information search the Internet site of RECYC-QUÉBEC at *http://www.recyc-quebec.gouv.qc.ca/* In the section *Centre de documentation* there is a document entitled "2002 - 2008 Québec Program for the Integrated Management of Scrap Tires." The same document is also available in French under the title "Programme québécois de gestion intégrée des pneus hors d'usage 2002 - 2008."

The Growing E-Waste Problem

K. Modesitt, J. Gilbert

*EM **2005**, May, 8-14*

Currently available at www.awma.org and www.environmental-expert.com

The authors begin with a startling statistic: "The average life span of a PC has shrunk from 4.5 years in 1992 to 2 years in 2005." The Silicon Valley Toxics Coalition predicted in 2002 that, in the United States, 500 million computers would become obsolete between 1997 and 2007. According to the EPA, the following elements are associated with e-waste: cadmium - found in chip resistors, infrared detectors, and semiconductors; lead - found in glass panels in computer monitors and in lead soldering on printed circuit boards; mercury - found in thermostats, position sensors, relays and switches, and discharge lamps; and chromium VI - used for corrosion protection and galvanized steel plates. After exploring the subject of the hidden costs of unmanaged e-waste, the authors talk about existing and upcoming guidelines and regulations in the United States and the European Union. In the United States there is currently no federal legislation covering e-waste, although a number of states have legislation enacted or pending. The European Union published two directives in 2003. The Waste Electrical and Electronic Equipment (WEEE) directive requires producers to recover and reuse e-waste. Beginning in July 2006, the Restriction of Certain Hazardous Substances (RoHS) directive bans cadmium, hexavalent chromium (CrVI), lead, mercury, and two types of brominated flame-retardants in consumer products. The article further describes EPA, state, industry, and

independent e-cycler initiatives, also giving advice on e-waste pollution prevention.

Challenging the Traditional Hydrometallurgy Curriculum - An Industry Perspective

M. B. Mooiman, K. C. Sole, D. J. Kinneberg

Hydrometallurgy ***2005****, 79, 80-88*

The authors proclaim that hydrometallurgical education needs to change as the primary processing of ores and concentrates, on which traditional hydrometallurgy research is focused, is being replaced by interest in recycling and reprocessing of secondary materials. In addition to operations management, a technical knowledge of complex environmental issues, risk assessment, materials selection, and process modelling and control is vital. The authors believe that hydrometallurgy could become the centre of a larger cross-disciplinary field dealing with all aspects of the chemistry and chemical engineering of industrial aqueous-based processes. They propose renaming the field to Hydrotechnology or Chemical Engineering of Aqueous Systems. A modern curriculum is proposed that expands the scope of study, maintaining a core focused on the extraction and recovery of metals using aqueous solutions, but also including allied fields in which the principles of classical hydrometallurgy apply (i.e., leaching, separations, precipitation, electrolysis.

Recycling of Aluminum to Produce Green Energy

S. Silva Martínez, W. López Benítes, A. A. Álvarez Gallegos, P.J. Sebastián

Solar Energy Materials and Solar Cells ***2005****, 88(2), 237-243*

The authors reacted post-consumer aluminum soft drink cans with sodium hydroxide in a spontaneous chemical

New Brunswick

New Brunswick's Tire Stewardship Program (TSP) was introduced in 1996, through an amendment to the Province's *Clean Environment Act*. The New Brunswick Tire Stewardship Board (NBTSB), which includes representation from the industry, as well as Provincial Department of Environment and Local Government, administers TSP recycling. The price of each car or truck tire sold in New Brunswick incorporates an environmental fee. For cars and other vehicles with tires up to 17 inches in rim size, the fee is $3. Larger tires, above 17 inches to a maximum of 24.5 inches, carry a $9 fee. The funds are used to partially subsidize the cost of collecting scrap tires anywhere in the province. Tire Recycling Atlantic Canada Corporation (TRACC) has been awarded an exclusive contract by the New Brunswick Government to manage scrap tires in the province. More information is available at *http://www.nbtire.com/*

Prince Edward Island

In 1999, the Prince Edward Island government incorporated the Island Waste Management Corporation, a provincial Crown corporation that administers and provides solid waste management services throughout PEI also handling the scrap tires management program. Prior to its inception, PEI imposed a $2 tire levy on each tire sold. Prince Edward Island is currently in negotiations with the province of Nova Scotia to recycle tires from PEI in Nova Scotia. At this moment most tires are baled and used in civil engineering applications.

Nova Scotia

In 1997 the Province of Nova Scotia appointed the Resource Recovery Fund Board Inc. (RRFB) to administer the used tire management program. RRFB Nova Scotia is a non-profit corporation managed by a board of directors with representatives from the private sector and government. An environmental fee of $3 is applied at the point of retail sale on all new passenger car tires. The same fee is applied to all light truck tires not exceeding 17 inches rim size and a fee of $9 is applied to all highway truck, tractor and trailer tires not exceeding 24.5 inches rim size. Used tires are transported to a recycling facility in the province where they are processed into various sizes of rubber "crumb." This rubber is remanufactured into products such as sport surfaces, carpet underlay, garden hoses, shoe soles, rubber mats, wheels, and speed bumps. More information is available at *http://www.rrfb.com/*

Newfoundland and Labrador

Since 2002, the Multi-Materials Stewardship Board (MMSB), a Crown agency of the Department of Environment and Conservation, has been responsible for the operations of the used tires recycling program. Retailers must remit a levy to the MMSB of $3 on new tires with a rim diameter of 17 inches or less, and $9 on new tires with a rim diameter between 17 inches and 24.5 inches. MMSB is currently collecting tires from retailers, municipal waste disposal sites, and highway depots operated by the Provincial Department of Transportation and Works and storing them in privately owned and operated storage yards. More than 1 million tires have been collected through the provincial government's tire recycling program. Unfortunately, in November 2005, the Corner Brook Pulp and Paper withdrew a proposal to burn old tires as fuel for its mill. Currently, the provincial government is reviewing its options in dealings with the stockpiles of stored tires.

Yukon
The Yukon Territory is the only Canadian Territory with a tire program. It was implemented in 2003, and a levy of $5 is collected on all new tires less than 24.5 inches in diameter. All tires are shipped to Alberta for processing.

This article was adapted from "Scrap Tire Recycling in Canada" by Alexandra Pehlken and Elhachmi Essadiqi, a project produced under the auspices of the Enhanced Recycling Program of Action Plan 2000 on Climate Change, Minerals and Metals.

THE ENHANCED RECYCLING PROGRAM
An Update

The *Enhanced Recycling* program, a component of the five-year Minerals and Metals Program of the *Government of Canada Action Plan 2000 on Climate Change*, is scheduled to wrap up in March 2006. The program has been successful in demonstrating and testing options intended to improve the recoverability of recyclable materials contributing to the advancement of the recycling infrastructure in Canada. Decisions on program activities have been guided by a multi-stakeholder Advisory Committee, consisting of representatives from all levels of government, industry associations and environmental non-governmental organizations. The range of interests and expertise in this Advisory Committee have allowed the *Enhanced Recycling* program to examine barriers to recovery and recycling for a wide range of material streams in diverse sectors. The collaboration of this group over the duration of the program has forged new partnerships and facilitated the exchange of new knowledge about recycling and implementation of the best practices related to recycling. Over the past few years, R-NET has highlighted several of the *Enhanced Recycling* program's projects. Here are a few more summaries of projects being carried out with the support of the *Enhanced Recycling* program:

QUEBEC CFER NETWORK - RECLAMATION PROJECT FOR INFORMATION TECHNOLOGY AND COMMUNICATION DEVICES

Since 1990, the network of CFERs (training centres in business and waste recycling) has developed and implemented recycling programs for various types of residual materials (paper, plastic, paint, cables, hardware from power and communication lines, etc.).

reaction resulting in high purity hydrogen subsequently used in a commercial proton exchange membrane (PEM) fuel cell to produce electricity. The hydrogen was produced from a recyclable material without supplying energy and with no air pollution. The metallic by-product ($NaAl(OH)_4$) was used to prepare a gel of aluminum hydroxide applied to the purification of arsenic-contaminated drinking water.

The Influence of Particle Size Reduction and Liberation on the Recycling Rate of End-of-Life Vehicles
A. van Schaik, M. A. Reuter, K. Heiskanen
Minerals Engineering ***2004****, 17(2), 331-347*
EU legislation requires that 95% of passenger vehicles be recycled in 2015. The authors devised a model for the optimization of the recycling of end-of-life vehicles. They included both particle size reduction and the liberation of materials as modelling parameters. The modelling was based on the knowledge derived from the modelling of minerals processing systems. Product design and material connections and combinations determine the particle size reduction and the degree of liberation of the product during shredding, both factors affecting the composition of the intermediate recycling streams and the efficiency of physical separation. The simulations reveal the complexity of modelling the breakage matrix for shredding modern consumer goods. The liberation behaviour differs fundamentally from that of mineral ores, i.e., true for classical grinding - the finer the grind the more liberated particles become - is not necessarily true for shredding of end-of-life consumer goods.

The Use of Air Tabling and Triboelectric Separation for Separating a Mixture of Three Plastics

G. Dodbiba, J. Sadaki, K. Okaya, A. Shibayama and T. Fujita

Minerals Engineering ***2005****, 18(15), 1350-1360*

A two-stage process has been proposed for the dry separation of mixed plastics prior to recycling. A mixture of virgin polypropylene (PP), polyethylene terephthalate (PET), and polyvinyl chloride (PVC) was investigated, as these plastics are widely used in the manufacture of everyday consumer products (such as beverage containers, household items, packaging, and furniture). First, an air table was employed and three fractions were obtained. A low-density product was composed of 95.4% PP with 95.7% of the PP collected. The high-density fraction contained 51.1% PVC and 48.0% PET with 95.1% of the PVC and 90% of the PET collected. There was a third fraction, which the authors call "the middling", which was not further investigated. In a second stage, the PET/PVC fraction was separated in a triboelectric separator utilizing differences in surface charge resulting from rubbing against the inner lining of the tribo-cyclone. At the end of this stage 67% of the PET was recovered. The purity of the recovered PET was 97.2%. The purity of the recovered PVC was 93.1% with a recovery rate of 76%. The authors discuss the influence of adjustable parameters on the recoverability and purity of the researched materials.

Creation of a Recycling-Based Society Optimised on Regional Material and Energy Flow

N. Goto, T. Tabata, K. Fujie, T. Usui

Energy ***2005****, 30(8), 1259-1270*

The authors model the conditions that are needed to establish a so-called

This recycling project for IT and communication devices is primarily being carried out in the CFER pilot locations of Bellechasse and Saguenay. The results will benefit the entire network of CFERs, where other members will be able to introduce similar recycling activities. The Outaouais CFER and the La Renaissance d'Abitibi Temiscamingue CFER are also participating in pilots in preparation for the introduction of collection systems in the domestic and institutional sectors in rural and urban environments.

As a leading Canadian innovator, the CFER network is endeavouring to advance concrete knowledge of reusing and recycling IT and communication devices. Such information is not currently available in the literature. Several of the partners involved would also like to see the CFER initiative promoted and implemented in other parts of Quebec and Canada.

The aim of this project is to implement a collection, reuse and recycling system for outdated IT devices throughout Quebec. The system will involve the evaluation of the social, economic and environmental performance of the various steps involved, from collection, through reuse, to final recycling of components. The specific objectives of the project are as follows:

- Pilot three collection systems for the institutional, residential and business sectors for urban and rural environments;
- Sort equipment received by weight and origin;
- Develop an innovative method for separating glass from cathode-ray tubes (CRTs);
- Perform a complete economic analysis of the various steps considered in the recycling project;
- Evaluate the reduction in greenhouse gases and environmental impacts that result from the pilot project;
- Deliver an activity report on the social, economic and environmental performance of this type of project;
- Develop and popularize an implementation guide for interested proponents;
- Develop an awareness-raising module for the travelling display (caravane) based on the importance of managing IT and communication devices responsibly.

As of October 31, 2005, the following activities had been completed:

- 222,500 kg of devices received (4 CFERs combined) for a total of 19,247 device recycled;
- 71,940 kg of devices received (2 CFERs combined) for a total of 6,223 devices reused;
- Development and implementation of a database for tracking IT and communication devices and components that have been recycled and reused;
- Implementation of a barcode system that allows IT devices to be identified according to their origin;
- Development of a method for separating CRT glass (implementation expected for early December 2005);
- Study conducted on industrial hygiene covering the health and safety aspects of recycling activities involving IT and communication devices;
- Installation of equipment for handling material to be shipped;
- Dissemination of knowledge related to recycling of plastics derived from IT and communication devices.

This endeavour complements the *Computers for Schools* program (a federal program that collects and refurbishes surplus computers and provides them to schools, libraries etc.) by "completing the loop." When a computer can no longer be refurbished for reuse, it must be properly dismantled and delivered to the appropriate recycling facilities.

Enhanced Recycling has supported a range of projects aimed at increasing recycling of IT equipment. This venture by CFER will fulfill the necessary "next steps" identified in these past projects for further characterization of the environment currently governing the fate of end-of-life electronics and how infrastructure can be developed and/or optimized to facilitate recovery.

For more information about the CFERs network, please visit http://www.uqtr.ca/chaire_cfer/reseau/ .

BACKGROUND STUDY ON INCREASING RECYCLING OF END-OF-LIFE MERCURY-CONTAINING LAMPS FROM RESIDENTIAL AND COMMERCIAL SOURCES IN CANADA

Pollution Probe

According to the Office of Energy Efficiency at Natural Resources Canada, the use of fluorescent lighting yields energy savings anywhere from 60% to 80% over conventional incandescent sources, and fluorescent bulbs typically last 10 to 20 times longer. Commonly used as commercial light sources in North America, residential use is on the rise, owing largely to increased consumer education about the energy efficiency of these products. In order to maximize the benefits of the use of these lamps, however, consumers need to be aware that fluorescent and high-intensity discharge (HID) lamps contain mercury and so should be recycled and not discarded with other household wastes. The Canadian Council of Ministers of the Environment (CCME) estimated that in 2001, approximately 60 million mercury-containing lamps were sold in Canada and that, "mercury-containing lamps, whether broken or intact, contribute about 1150 kg/year of mercury to landfill each year bound to the phosphor in the glass." Mercury releases from landfilling and incineration of these products, when they reach the end of their useful life, can have serious adverse impacts on environment and human health due to the toxicity and persistence of mercury and its ability to bio-accumulate in living tissues.

Responsible life-cycle management of these products also means that the valuable components materials - such as brass, copper, glass, mercury, phosphor powder and aluminum - can be recovered through the recycling process for reuse, reducing the demand for virgin resources. Using recycled materials - especially in the case of metals - to manufacture new products also reduces the energy burden and greenhouse gas emissions associated with mining, smelting and refining raw metals. Despite a high recycling potential, *Pollution Probe* has found that the infrastructure for recycling of mercury-containing lamps in Canada is limited. Their analysis included a survey of Canadian municipalities, aimed at shedding light on the main barriers to effective lamp

"recycling-based society" - a society with a low environmental load. The most important factor in such a society is the efficient use of human and industrial resources. A regional system must be constructed, which not only reduces waste in the manufacturing process, but also utilizes the by-products of other industries thereby optimizing material flow. The authors call the by-product utilization among industries an "industrial network." The extent of by-product and post-consumer recovery affects the energy balance in the recycling process. To envision a feasible recycling-based society, energy supply and demand must be examined. The modelled region was the Aichi prefecture located in the centre of Japan.

Effluent Treatment and By-Product Recovery from the Sludge of an Alumina Plant

A. Agrawal

Minerals Engineering ***2005****, 18(4), 463-465*

Vanadium-bearing sludges of the alumina industry are the only indigenous source of vanadium in India. The recovery of vanadium pentoxide from the sludges generates 2.5 x 10^7 litres of highly toxic effluents annually. Due to their toxicity, these effluents cannot be discharged on land or in water. The author reports that a process has been developed that recovers 95% of vanadium pentoxide contained in the effluents as well as 90% of the ammonia. Chemical reactions and the optimization parameters for the recovery of ammonium salts and vanadium pentoxide are discussed.

THE SUPPLEMENTARY CEMENTING MATERIALS PROGRAM

The Supplementary Cementing Materials (SCMs) program is also a component of the five-year Minerals and Metals Program of the Government of *Canada Action Plan 2000 on Climate Change*. The SCMs program is an appropriate complement to the Enhanced Recycling program, in that it involves putting materials currently viewed as wastes - in this case industrial by-products like fly ash and blast furnace slag - back to work in the economy, resulting in greenhouse gas reductions.

The aim of this program is to support the development and delivery of a wide range of tools to promote an increased use of SCMs (for displacing a portion of cement in concrete manufacturing) among key stakeholders including governments, private sector property developers, cement and concrete producers, architects, and engineers. The production of one tonne of cement produces a nearly equivalent amount of carbon dioxide, about half coming from the energy demands of the process while the other half is associated with the calcination of limestone. Using supplementary cementing materials to replace some of the cement in concrete thereby reduces its "CO_2 signature."

Considering that Canadian total concrete utilization is approximately 24 million tonnes per year, finding a low emission intensive method of producing concrete is an important step for

recovery. They found that main barriers included: lack of knowledge of the environment and health impacts of landfilling lamps; shipping, handling and storage issues; costs; geographic issues including distance to suitable recyclers; and lack of enforcement and regulations regarding the disposal of spent lamps. The aim of another survey sent to the five Canadian companies that recycle spent lamps was to gain quantitative information about the material constituents of mercury-containing lamps that are delivered to recycling facilities, including amounts of glass, combined metals, phosphor powder and mercury and to estimate the current national recovery rate (found to be only about 7%). *Pollution Probe* also used this material information to estimate the impact on greenhouse gas emissions of recycling these constituent materials.

The real value in economically and safely recovering and recycling spent lamps is to prevent harm to the environment and human health through exposure to mercury, and to promote the conservation of natural resources by re-inputting the constituent materials back into the economy to make new products like feed for smelters (end caps) and fibreglass (glass). Mercury can be separated from the phosphor and used again in other applications. Moreover, the responsible use of mercury-containing lamps (i.e., recycling them at end-of-life rather than landfilling them) can actually help to reduce the overall amount of mercury entering the environment. Because of the energy efficiency benefits they offer over incandescents, mercury-containing lamps like fluorescent tubes, compact fluorescent lamps and high intensity discharge lamps, reduce the demand for energy from mercury-emitting coal-fired power plants.

FACILITATING GREATER REUSE AND RECYCLING OF STRUCTURAL STEEL IN THE CONSTRUCTION AND DEMOLITION PROCESS

School of Architectural Science at Ryerson University, with support/input from the Canadian Institute for Steel Construction, Spec-Sec Fabricators, Halsall Engineering, Russel Metals, Dofasco Steel and Priestly Demolition

Recycling and reuse of steel generates reductions in greenhouse gas emissions by saving on primary steel production, generating less waste, and using less energy. However, there is little information in Canada about reuse and recycling rates for structural steel, and, although some designers are willing to redesign their projects to make use of available reused structural steel components, it is often difficult to identify suitable materials in the local area at the appropriate time in a project life. A limiting factor for a greater adoption of reuse of steel components is the lack of a well-established mechanism for their exchange. Demolition companies usually sell the steel elements to scrap merchants feeding back into the steel-manufacturing loop. This practice is driven by the high value of scrap steel. There is a lack of a mechanism to make available steel elements easily accessible to designers, construction companies, and others who may wish to use such components in new construction projects. The goal for this project is to develop a greater understanding of the materials flows in the steel construction sector, and subsequently to use this knowledge to provide the tools that will facilitate greater reuse and recycling of construction-derived steel.

COLLECTION, TRANSPORTATION, STORAGE AND RECYCLING OPTIONS FOR SPENT SINGLE-USE PROPANE CYLINDERS IN CANADA

The Nova Scotia Department of Environment and Labour

More Canadians are purchasing small, non-refillable propane cylinders for use in the outdoor stoves, lanterns and torches. It is estimated that 2.2 million single-use propane cylinders are consumed annually in Canada. However, due to the lack of a recycling system for these products, the resources embedded in the steel cylinder are lost to disposal, representing missed opportunities for energy and greenhouse gas emission savings. These cylinders pose a fire and explosion risks if they are improperly handled at the time of disposal. They impose financial burdens on municipalities that must treat them as hazardous wastes and dispose of them accordingly to hazardous wastes regulations. The production of replacement cylinders requires consumption of raw materials (natural gas or oil, iron ore, coal, and limestone). The Nova Scotia Department of Environment and Labour is examining the feasibility of comprehensive collection and recycling programs for single-use propane cylinders in Canada. Their final report will identify current programs, locate landfill operators / scrap dealers who have the experience in dealing with propane tanks, describe the processing methods; and examine promising options for a propane cylinder recycling system. The report will also incorporate safety and collection issues, potential markets and the feasibility of the implementation of the Extended Producer Responsibility programs.

Canadian Association of Recycling Industries

Recycling Leadership

by Leonard Shaw

"Our Common Future" (more commonly known as the Brundtland Report) was written by the World Commission on Environment and Development after three years of public hearings, more than five hundred written submissions, and analysis by Commissioners from twenty one countries. The final report was submitted to the United Nations General Assembly in 1987 and led to general support for "sustainable development." Sustainable development was defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." Such an endeavour is an example of leadership on a world scale.

Since that report, governments at every level and all over the world have adopted and openly promoted sustainable development. Arising naturally from this concept has been support for activities such as reducing, reusing, and recycling of our natural resources. It is well known that recycling in particular reduces the need to

Canada in reaching its Kyoto Protocol reduction targets. As by-products of their respective industries, there are no CO_2 emissions associated with the production of SCMs. An additional benefit of using SCMs is that the long-term strength and durability of the resulting concrete is often improved, and the production cost is lowered.

With input from the SCMs program, the International Centre for Sustainable Development of Cement and Concrete (ICON/CANMET) at Natural Resources Canada in partnership with Public Works and Government Services Canada (PWGSC) developed guidelines on the use of SCMs in concrete for incorporation in the new edition of the National Master Specification (NMS) of PWGSC. Although these specifications are intended for construction of federal infrastructure, the NMS is well respected and used by contractors for concrete structures other than those of the federal government. Also, new clauses/recommendations for the use of concrete incorporating large volumes of SCMs were included in the new edition of the Canadian Standard Association (CSA) concrete specification (A23.1 and A23.2). These key documents represent "concrete" tools to help Canadian organizations in the construction sector, to better deal with the foreseen increase in GHG emissions resulting from the booming infrastructure demand (new construction and repairing of existing aging infrastructure) across the country.

The use of large amounts of SCMs in concrete construction is a key element in the design and implementation of "sustainable infrastructure" development. Manufacturing concrete incorporating large volumes of

SCMs is generally cost effective and actually can increase competitiveness within the construction industry. Concrete incorporating large volumes of SCMs, when properly designed and manufactured, can be significantly more durable and consequently last longer than conventional concrete infrastructure. High profile concrete structures such as the Confederation Bridge (between Prince Edward Island and New Brunswick) have used SCMs with the specific objective of increasing their service life, 100 years in the case of the Confederation Bridge. This will translate into low rehabilitation costs, and long-term savings of resources (raw materials for cement production, coarse and fine aggregates, etc.) and reductions in GHG emissions related to materials manufacturing and processing.

A large element of the SCMs Program to date has been communication of the benefits of using SCMs to target audiences. A key partner in this regard has been the Association of Canadian Industries Recycling Coal Ash (CIRCA). CIRCA promotes the recycling of coal combustion products for technically superior concrete products and supports efforts to develop non-traditional applications that will expand coal combustion products utilisation. Check out some of CIRCA's (award-winning) resources at: *http://www.circainfo.ca/resources.htm* The SCMs Program also has a program website available at *http://www.scm.gc.ca/*

use scarce raw materials, reduces primary process wastes and air and water effluents generated by primary processing, reduces energy consumption, reduces the need for landfill sites, and creates jobs in populated areas. Unfortunately, the concrete actions that follow the many supportive statements about recycling demonstrate that these same governments are really only paying lip service to the concepts that they publicly promote.

As an example, in the 1993/94 Solid Waste Action Plan of the Solid Waste Management Task Group of the Canadian Council of Ministers of the Environment, a council of all provincial and territorial ministers of the environment plus the federal minister, identified the area of federal and provincial tax disincentives to secondary material processing and marketing as a high priority for action. They therefore commissioned a study entitled “Taxation of Virgin and Recycled Materials: Analysis and Policy.” Clearly an example of leadership.

After examining metals, paper, plastics, and glass the 1995 final report concluded that, on average, effective tax rates on virgin products are less than on recycled products by three percentage points. Except for plastics, recycled materials are taxed more than virgin materials. In particular, the cost of production of fabricated metal products is 4.5% higher for recycled products. Put another way, fabricated metal products made from recycled metals at that time cost $280 million more to produce in Canada than products fabricated from primary metals. To date no changes have occurred in the tax structure to address this fact. Recycled materials are still taxed more than virgin materials. Such inaction is clearly inconsistent with the espoused support for sustainable development.

Similarly in 1996 the Federal Government revised its minerals and metals policy. It was the first attempt by the Government to incorporate the concept of sustainable development into a comprehensive policy document in the natural resources area. For the first time there was a section devoted to recycling of minerals and metals. Among other things the Government committed “to enhance the efficiency and effectiveness of regulations and remove unnecessary impediments to recycling” and “to promote, in both domestic and international fora, common approaches to the definition of waste that underline the need to differentiate between metal-bearing recyclable materials destined for recovery operations on the one hand, and wastes destined for final disposal on the other.” Again this was leadership.

On November 1, 2005 new Export and Import of Hazardous Waste and Hazardous Recyclable Material Regulations came into effect. These regulations are the vehicle that Canada has developed in order to ratify the Basel Convention. The amending of these regulations provided the government with an opportunity to enact their support for recycling as announced in its policy. However, rather than support recycling by separating waste and recyclable materials into two sets of regulations, they were kept together.

The Basel Convention that Canada has endorsed has a sound and sensible premise; to stop developed nations "dumping" their hazardous wastes on developing nations, even those willing to accept these wastes in order to receive foreign currency, because they lack to ability to manage the hazardous materials in an environmentally sound manner. However, the convention includes some recyclable materials in its definition of hazardous waste and has actually discouraged some recycling. The third amendment to the Convention will, if ratified, ban the export from OECD countries to non-OECD countries of hazardous recyclables that are destined for recovery operations. A United Nations study, conducted by Dr. Hoffmann completed in early 1999 on the impact of the "ban amendment" on lead acid batteries in the Philippines, found that the ban could lead to reduced access to spent batteries for the primary regulated company. This would negatively impact their productivity to the point where operating costs could become uneconomical. However, the increase in demand for domestic used batteries would lead to more "back yard" or non-regulated recycling (i.e., less environmentally soundly managed). This is exactly contrary to the objective of the Basel Convention. Canada is on record stating that it will not ratify this amendment if the definition of material classes negatively impacts the trade of legitimate recyclable materials. Real leadership would have Canada examining its membership in this convention.

At the provincial level Ontario, showed leadership in 1992 by supporting research on recycled rubber tires used in asphalt in Grey County. The county has eliminated the potential of another Hagersville fire because all of its old tires are now collected, crumbed, and recycled. The county roads are quieter, safer, and cheaper. Specifically, the recycled rubber has led to noise reduction. The roads have less rutting, which can lead to hydroplaning when the ruts are filled with water, and additionally have higher skid resistance. The roads are less expensive to build and maintain, and they have a longer life because there is less cracking. Less aggregate is required in their construction, and the asphalt layers can be thinner. The roads can be laid earlier and later in the construction season and the darker road surfaces require less salt in the winter. The manager responsible for this work has won international awards. Ontario lays thousands of kilometres of roads every year but it still has not introduced a policy to use recycled tires, even though it paid for the research and demonstrated all of the positive benefits.

This contradiction between supportive statements on the one hand, and incongruous statements or inaction on the other hand, occurs everywhere inside and outside of Canada. However, Canada has an international reputation as a leader in natural resources. Real actions by all Canadian governments in support of the many policies already enunciated will not only strengthen our environment and our economy, but will enable Canada to become a world leader in all natural resources, secondary as well as primary.

For further information regarding the above article, or for information on CARI's activities and membership, please contact Dr. Leonard Shaw. Tel.: (613) 256-8533, Fax: (613) 256-8534, Email: len.shaw-cari@on.aibn.com

CARI's Corner

GLOBE 2006
March 29-31, 2006
Vancouver, British Columbia, Canada
Phone: (604) 775-7300
Email: info@globe.ca
Web: www.globe2006.com/

17th Global Warming International Conference
April 20-21, 2006
Miami, Florida, USA
Email: gw17@globalwarming.net
Web: www.globalwarming.net/

The Canadian Environmental Conference and Tradeshow
May 1-2, 2006
Toronto, Ontario, Canada
Phone: (905) 727-4666
Fax: (905) 841-7271
Web: www.canect.net/

First National Environmental Exhibition
"Tools for understanding and acting"
June 1-4, 2006
Montréal, Québec, Canada
Web: www.salondelenvironnement.org/

CARI's 65th Annual Convention
June 24-26, 2006
Mont Tremblant, Québec, Canada
Phone: (905) 426-9313
Email: donna.turner-cari@on.aibn.com
Web: www.cari-acir.org/

2006 Plastic Recycling Conference & Trade Show
June 25-27, 2006
Chicago, Illinois, USA
Email: mmiller@giemedia.com
Web: plasticsrecyclingconference.com/

Paper Recycling Conference & Trade Show
June 25-27, 2006
Chicago, Illinois, USA
Email: registration@gie.net
Web:
www.paperrecyclingconference.com/

Recycling Metals from Industrial Waste, a short course and workshop focussing on plant practice (14th year)
June 27-29, 2006
Golden, Colorado, USA
Phone: (303) 273-3321
Fax: (303) 273-3314
Email: space@mines.edu
Web:
www.mines.edu/Outreach/Cont_Ed/

11th International Congress for Battery Recycling
June 28-30, 2006
Interlaken, Switzerland
Web: www.icm.ch/index_battery06.htm

ENVIROtech Congress CEE 2006
June 29-30, 2006
Warsaw, Poland
Web: www.envirotechcongress.com/

The Recycling and Waste Management 2006
September 12-14, 2006
Birmingham, United Kingdom
Phone: +44 (0) 20 8277 5113
Fax: +44 (0) 20 8277 5128
Web: www.rwmexhibition.com/

2006 Recycling Council of Alberta Waste Reduction Conference
September 20-22, 2006
Edmonton, Alberta, Canada
Phone: (403) 843-6563
Fax: (403) 843-4156
Web: www.recycle.ab.ca/

European Paper Recycling Conference
September 25-26, 2006
Barcelona, Spain
Web : www.paperrecyclingeurope.com/

Educational & Kids' Resources About Climate Change and Recycling

Respect for the Earth and its resources is not an attitude that someone develops overnight. It comes from learning at an early age about the value of resources and the effects that human activities inflict on the environment. The subjects of resource conservation, carbon dioxide emissions, global warming and recycling may not normally have kids squirming with excitement at their desks. Adding an element of interaction through games and other "activities" can increase the uptake of this vital information by the generation in whose hands the Earth will be, and add some fun to learning.

Natural Resources Canada features a bilingual Internet web page (***http://www.nrcan-rncan.gc.ca/kids***). The site contains links that will help kids with their homework (geography, science and technology, nature, and environment). Enquiring minds will discover a link to "A History of Mining and Mineral Exploration in Canada and Outlook for the Future" by Donald A. Cranstone, a comprehensive report on production, reserves, and exploration results. The site contains e-postcards with energy saving tips that the children can send out. There is educational entertainment under the heading "Games and quizzes" and a link to a "Calendar Club", a website with information about energy and energy efficiency. There, the kids can explore the animated Club House, ride in the NRCar, and take the "One-Tonne Challenge."

United States Environmental Protection Agency (EPA), the Office of Solid Waste Educational Resources website (***http://www.epa.gov/epaoswer/education/index.htm***) encourages students to see the environmental results of their choices in school and in their private lives. The site concentrates on three groups of students. ***Planet Protector Club*** is designed for young children up to grade 5. The mission of a Planet Protector is to improve the world by generating less trash and to help other people learn to reduce, reuse, and recycle. ***Make A Difference Campaign*** is intended for children in grades 6-8 to "make informed decisions for protecting the environment in their day-to-day life." ***Your Life, Your World, Your Choices, You Can Change the World*** is directed towards teens in grades 9-12. This campaign teaches about resource conservation and environmental protection. Each level includes an array of information, games, and activities. One of our favourites is the "Trash and Climate Change Fortune Teller Game" (***http://www.epa.gov/epaoswer/osw/k00-001.pdf***).

Global Warming Kids site is another EPA site that is worth recommending (***http://www.epa.gov/globalwarming/kids/index.html***). It focuses on the science and impacts of global warming. The page features games, animations, events, and links to other relevant sites. The site includes a ***Global Warming Wheel Card*** for estimating household's emissions of carbon dioxide. One side of the wheel illustrates how much carbon dioxide a household expels to the atmosphere per year. The other side shows how changes in behaviour (such as buying a more fuel-efficient car) can reduce the overall emissions. The wheel can be downloaded as a pdf file, and comes with detailed assembly instructions.