

THE MAGAZINE OF CANADA'S CHEMISTRY INDUSTRY

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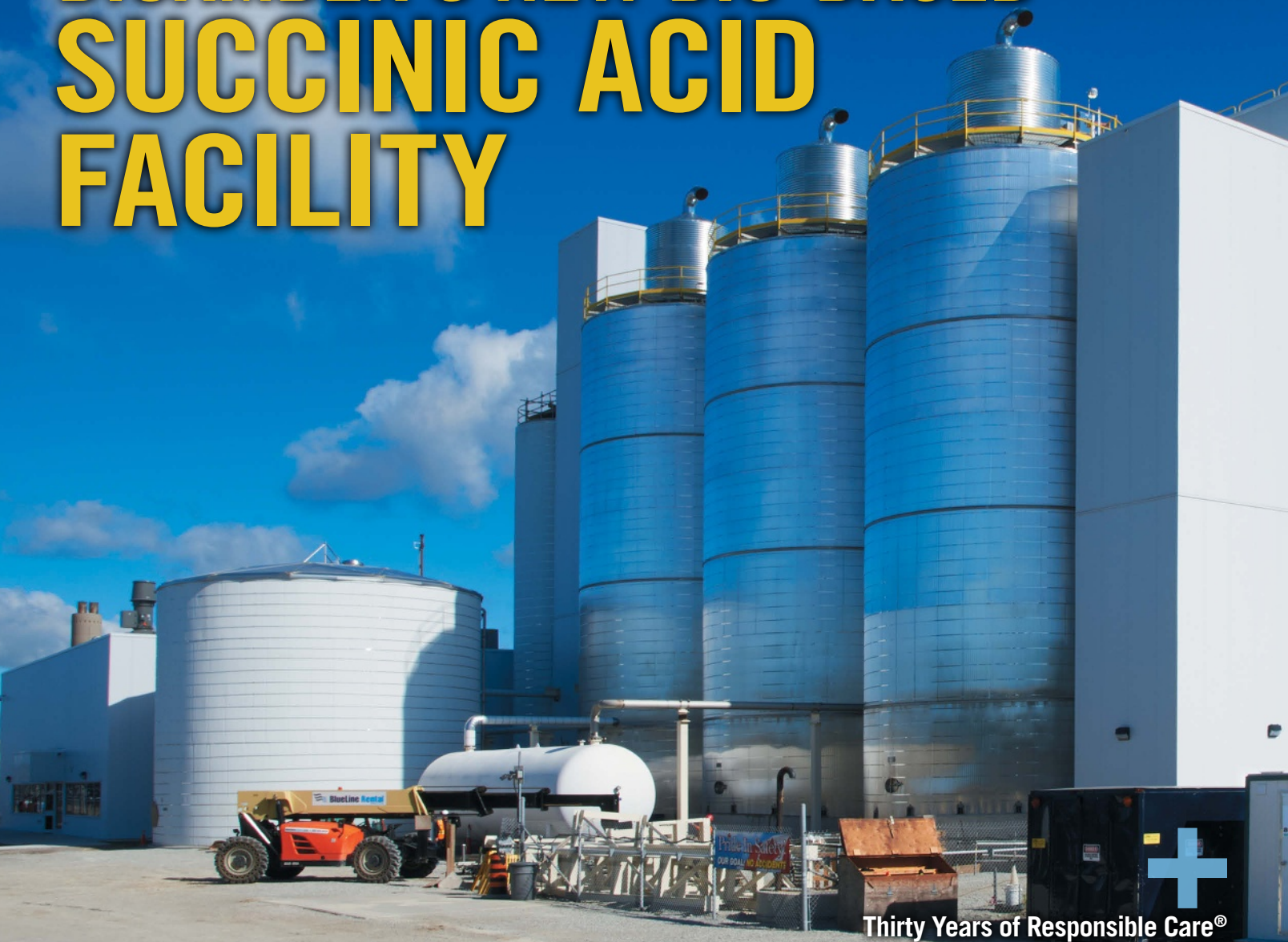
Catalyst



CHEMISTRY INDUSTRY
ASSOCIATION OF CANADA

ASSOCIATION CANADIENNE DE
L'INDUSTRIE DE LA CHIMIE

BIOAMBER'S NEW BIO-BASED SUCCINIC ACID FACILITY



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Sub-National Governments in the
Climate Change Conversations

GreenCentre Canada Expands its
Chemistry Innovation Services



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150 years

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We create chemistry

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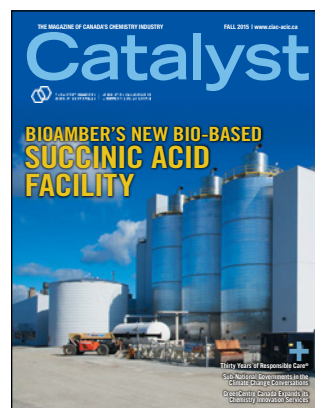
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Responsible Care®, an initiative of the Chemistry Industry Association of Canada, is an ethic for the safe and environmentally sound management of chemicals throughout their life cycle. Invented in Canada, Responsible Care® is now practiced in 60 countries.

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By Pierre Gauthier

BUILDING A SAFE, COMPETITIVE, AND SUSTAINABLE CANADIAN RAIL TRANSPORTATION SYSTEM

RAIL TRANSPORTATION IS essential to the business of chemistry, to Canada's economy and trade, and to the sustainable future of our communities. For these reasons, the Chemistry Industry Association of Canada (CIAC) welcomed the federal government's 2014 announcement to launch the statutory arm's-length review of the *Canada Transportation Act* (CTA). The Review Panel has a mandate to examine whether Canada's transportation system has the capacity and adaptability to respond to evolving conditions and markets during the next 20 to 30 years.

The last comprehensive review took place in 2001 and it resulted – through new legislation in 2008 (Bill C-8) – in some significant changes to the CTA. Since then, the government has introduced a number of legislative measures – namely Bills C-52 and C-30 – to address issues related to service levels, rail safety, and the imbalance in the relationship between the railways and the shippers. The legislative actions have helped to rebalance the relationship between the railways and shippers resulting from the market dominance of the two Class 1 rail carriers and put Canada's rail transportation system on the right track. But we still have some distance to go.

Chemistry is a \$53 billion industry and is the second largest manufacturing exporter in Canada, exporting \$32 billion worth of goods abroad annually. The industry – which supports some 81,000 jobs directly, and another 485,000 indirectly – is poised for growth, with a potential \$10 billion of new investment during the next five to ten years. Having a first-rate rail transportation system is an essential factor that will help win new investment.

With two-thirds of the industry's products moving by rail, rail transportation is the preferred mode of transportation to service Canadian, North American and global supply chains, and the chemistry industry depends on it. For many facilities and products, rail is the only feasible mode for moving chemical products, and the Railway Association of Canada (RAC) identified rail as the "safest mode of transportation for these products."

Many goods essential to our economy and way of life are produced by the chemistry industry, including several products labelled as dangerous goods, such as chlorine, to purify our drinking water, or sulphuric acid that goes into car batteries and agricultural fertilizers. To ensure the safe handling and transportation of these products, CIAC and its members created the TRANSCAER® (Transportation Community Awareness and Emergency Response) program in 1985. Today, TRANSCAER® members and partners – led by CIAC and RAC and supported by

a number of associations – work collaboratively to ensure transportation safety best practices are shared and training and emergency preparedness activities are carried out across Canada.

Canada's rail freight transportation system has been characterized as a dual monopoly, dominated by the two Class 1 carriers. Unfortunately, this leaves the chemistry industry vulnerable to issues of service, capacity and competitiveness. Given both the importance of the chemistry industry and its reliance on rail, we need to ensure access to a timely, reliable and competitive rail system.

CIAC's submission to the CTA Review Panel focussed exclusively on addressing complex rail transportation issues including:

- **Railway Safety:** Maintain the common carrier obligation for the transportation of dangerous goods (TDG).
- **Efficient Operations:** Develop full metrics to measure railway performance.
- **Competitiveness:** Improve the functioning of Service Level Agreements (SLA) and ensure railways are accountable to deliver on the commercial, or arbitrated, terms in SLAs.
- **Competitive Access and Service Levels:** Ensure effective regulatory access to alternative rail carriers by:
 - Removing the prior agreement provision in competitive line rates.
 - Expanding inter-switching for all shippers to the first interchange.
- **Railway Capacity:** Ensure investment in Canada's rail transportation system is driven by commercial incentives to support increased trade and economic growth.

CIAC also recommends the mandate of the Canadian Transportation Agency be broadened to allow the agency to investigate and address systemic shortfalls in rail service, capacity and infrastructure. In addition, the Agency should be authorized to collect, maintain and publish data detailing the railways' performance.

Implementing these recommendations will go a long way towards building a safe, competitive, and sustainable rail transportation system. By optimizing Canada's rail transportation system, we can be confident the chemistry industry will be positioned to realize its potential for investment and growth – and to play an even larger role in expanding and strengthening the Canadian economy. ●

Pierre Gauthier is Vice-President, Public Affairs, Chemistry Industry Association of Canada.

DOING THE RIGHT THING ... FOR 30 YEARS AND BEYOND

IN THE 1980s, pressures to regulate Canada's chemistry industry were growing, galvanized by spills and transportation incidents in Canada and abroad and public mistrust of the industry. The solution: make a commitment to doing the right thing.

Between 1985 and 1988, members of the Chemistry Industry Association of Canada (CIAC), then known as the Canadian Chemical Producers' Association (CCPA), drafted the first Responsible Care® Codes – stringent guidelines for safe and environmentally sound chemicals management. A National Advisory Panel made up of academics, environmental leaders and community members was formed to provide timely advice including the need for a public component to the verification process.

In 1992, CIAC members began voluntarily reporting their environmental emissions under Responsible Care. A year later, CIAC introduced the Responsible Care® public verification process involving industry experts, public advocates and local community representatives to assess whether companies were living up to their commitments. In 2010, the Responsible Care Ethic and Principles for Sustainability, and the Responsible Care Codes were completely rewritten to reflect more exacting sustainability standards. Responsible Care® is practised in more than 60 countries worldwide.

Following are quotes from some of people who have helped create and sustain the industry's commitment to Responsible Care®:

Responsible Care® Leaders: in their own words

Foundations

"Very quickly we came to the conclusion that calling the thing hazardous chemicals is ludicrous every chemical is hazardous ... and so we said we've got the wrong perspective we've got to talk about the hazards of chemicals. And that turned it to be about the development, manufacturing, handling and use and disposal."

John E. Akitt (1933-2014), former executive vice-president of Esso Chemical Canada, and member of CCPA's 1977 ad hoc policy group on the management of hazardous chemicals.

Effectiveness



"It sounds cliché, but people would actually get tears in their eyes when they spoke about their commitment to Responsible Care ... It's because they no longer had to park their ethics at the plant gate. They could be proud of the work they did..."

Brian Wastle, former Vice-President, Responsible Care®, 1991-2010.

Transparency

"Perhaps the National Advisory Panel's greatest legacy is an insistence that compliance with Responsible Care be independently verified – and in a way that included public participation.

That decision built transparency right into the program from the start."

John Vincett, founding and present facilitator of the National Advisory Panel.

Vision



"At BASF, we embrace the goals of Responsible Care by not only working with customers and suppliers to ensure our products are handled safely, but also collaborating with stakeholders along

the value chain to better position our society for a sustainable future."

Carles Navarro, President, BASF Canada

Future



"Responsible Care should remain relevant for at least another 30 years. The pace of change and range of issues facing it are increasingly testing our societies. It's only by staying focused on these

two critical elements – trust and people – that Responsible Care will continue to be recognized as worthy of trust and central to a better industry and a better world."

Jean Bélanger, Order of Canada, founder of Responsible Care®.

Value

"I had the opportunity to ask a member-company President to describe the value of Responsible Care. Without hesitating he said all of his company's continuous improvement results in the past 15 years came from being exposed to the leading practices and lessons learned through networking with Responsible Care companies."

Bob Masterson, Vice-President, Responsible Care®, Environment and Health.

CIAC's Incoming President



On Sept. 1, CIAC President and CEO Richard Paton announced Bob Masterson, Vice-President, Responsible Care®, Environment and Health as his successor effective

Dec. 1, 2015. Mr. Paton has led the association for the past 20 years and will retire on Dec. 31, 2015. Bob joined CIAC in 2010 as Vice-President, Responsible Care® and in July of this year, he assumed the role of Vice-President, Responsible Care®, Environment and Health. A seasoned advocate of the chemistry industry, Bob brings more than 15 years of industry association leadership experience through his work with national and international trade associations in the energy, mining and forest products sectors.



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RESPONSIBLE CARE®
OUR COMMITMENT TO SUSTAINABILITY

TransCAER®



By Arnaud van Dijk

TAKING SUSTAINABILITY INITIATIVES TO THE NEXT LEVEL

THERE IS A growing trend amongst companies to quantify their positive and negative impacts on society and the environment in financial terms.

Sustainability has long been on the radar of the chemistry sector, as demonstrated by the 30th anniversary of Responsible Care®, the industry's sustainability initiative; the surging number of green solutions; and, increased transparency by companies on environmental, and health and safety impacts. However, leading companies are going beyond this traditional approach to sustainability and are taking it to the next level by monetizing their impacts across their value chains.

Global companies such as NovoNordisk, Volvo, and Kingfisher are following the approach pioneered by sportswear company Puma with its 'Environmental Profit & Loss statement' in 2010.

Increasing pressure from three key drivers – regulation and standards, stakeholder action, and market dynamics – may demand

that Canadian chemistry companies also adopt this approach going forward. A KPMG International study estimated that on average, 43 per cent of earnings in the chemistry sector would be wiped out if companies had to fully account for their environmental impacts¹. We're already seeing evidence of the internalization of environmental and social costs in Canada, for example through stakeholder pressure, B.C.'s carbon tax, Alberta's Specified Gas Emitters Regulation, and Quebec's – and soon, Ontario's – cap-and-trade system for reducing greenhouse gases (GHG).

Explaining and Monetizing Contributions: A Key Differentiator

Anticipating the internalization of these costs may give insight into future earnings at risk, and create an opportunity for management to identify strategic initiatives which demonstrate the positive social and environmental value the company generates.

Together, the monetization and internalization of social and environmental impacts provides an objective base for improved internal business case assessment and dialogue with external stakeholders.

However, even today, most businesses still struggle to achieve this due to a fragmented landscape of initiatives for reporting on value creation (e.g. the Natural Capital Coalition, International Integrated Reporting Council, and Sustainability Accounting Standards Board). What is more, companies are unsure how to successfully monetize 'externalities' and tie them to their financial performance.

How to Determine a Company's 'True' Value

Chemistry companies can adopt a three-step process, which can be applied successfully across different sectors.

Step 1. Identify and Quantify True Earnings

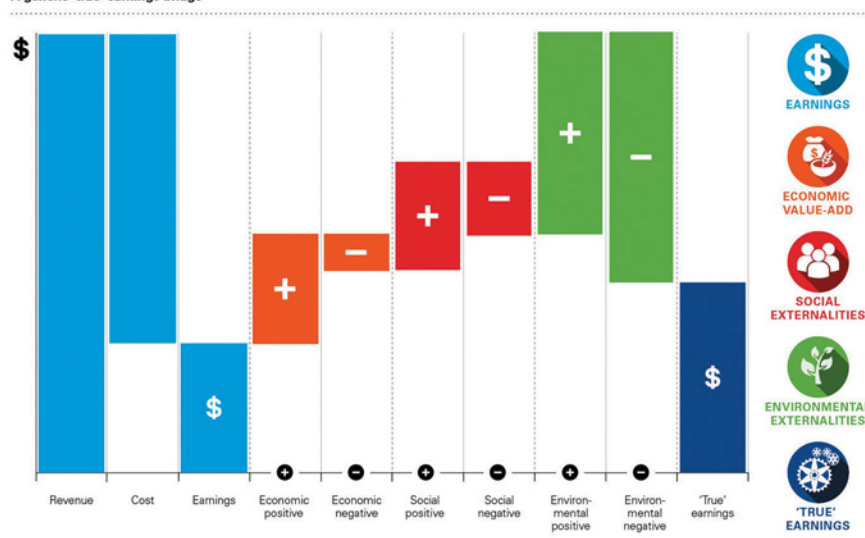
This includes assessing the value a company creates and reduces for society through identifying positive and negative externalities.

Material positive externalities could include the training provided to workers in facilities or the surplus energy your plants create and contribute to the grid through the use of solar panels or heat recovery systems. Material negative externalities could include the amount of GHG emitted during the manufacturing process or the downstream impact of waste on the environment.

Step 2. Assess the Risks to Your Future Earnings

Evaluate the extent to which these positive and negative externalities might be

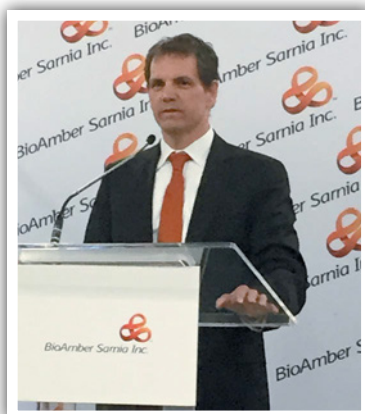
A generic 'true' earnings bridge



Source: KPMG (2014). A New Vision of Value: Connecting corporate and societal value creation.

continued on page 16

BioAmber's New Bio-Based Succinic Acid Facility



Jean-François (JF) Huc, President and CEO of BioAmber speaking to the participants at the BioAmber Sarnia Inauguration.

"WE'RE EXCITED THAT OUR RENEWABLE CHEMICALS MADE FROM SUGARS ARE MAKING EVERYDAY APPLICATIONS AROUND THE WORLD MORE SUSTAINABLE. WE BELIEVE OUR DISRUPTIVE BIOTECHNOLOGY IS GOING TO PROFITABLY DELIVER BENEFITS FOR THE ENVIRONMENT, OUR CUSTOMERS, OUR SHAREHOLDERS AND THE SARNIA LAMBTON COMMUNITY."

– JF HUC, PRESIDENT AND CEO OF BIOAMBER.



Part of the purification process for bio-based succinic acid.



The Control Room at BioAmber Sarnia which monitors all the systems in the plant.



The new plant has state-of-the-art equipment that allows it to produce renewable chemicals.

BIOAMBER, A LEADER in renewable chemistry, celebrated the opening of its new manufacturing facility in Sarnia, Ontario on August 5, 2015.

A joint venture between BioAmber and Mitsui & Co., the facility produces bio-based succinic acid from glucose sourced from southern Ontario agricultural suppliers. It is the largest succinic acid production facility in the world and will be globally competitive while making its chemicals more sustainably.

“We’re excited that our renewable chemicals made from sugars are making everyday applications around the world more sustainable,” says JF Huc, President and CEO of BioAmber. “We believe our disruptive biotechnology is going to profitably deliver benefits for the environment, our customers, our shareholders and the Sarnia Lambton community.”

The August 5th event was attended by many local and provincial dignitaries including Sarnia MP Pat Davidson; the Hon. Deb Matthews, MPP for London North Centre; and the Hon. Brad Duguid, Ontario’s Minister of Economic Development, Employment and Infrastructure.

“The opening of the BioAmber Sarnia facility is key to the development of Sarnia’s very unique bio-industrial complex,” said Mr. Duguid. “Working from within the existing chemistry cluster in Sarnia is an economic and environmental win for the community and the province.”



The Quality Control Lab where product is tested.

BioAmber broke ground on the facility in 2013 creating 300 construction jobs and 60 full-time jobs. Many of the plant’s operators are graduates from Lambton College, an institution known for delivering programs and graduates to meet the needs of industry both locally and across the country.

BioAmber Sarnia is part of the growing bio-industrial cluster in Sarnia Lambton and has received support from the Government of Canada and the Government of Ontario through the Ontario Ministry of Economic Development, Employment and Infrastructure’s Strategic Jobs and Investment Fund. The project also received support from the Sarnia Lambton community and Bioindustrial Innovation Canada, an organization committed to helping industry turn renewable resources into value-add chemicals. BioAmber Sarnia’s financial partners include Export Development Canada, the Farm Credit Corporation and Comerica Bank. ●

Quick Facts

- Bio-based succinic acid can be used in the production of plastics, paints, textiles and coatings, artificial leather, food and flavours and personal care products.
- 100 per cent reduction of Greenhouse Gas (GHG) emissions compared to the equivalent production process that uses petroleum.
- Approximately 300 construction jobs and 60 full-time jobs were created; many of the plant operators are graduates from Lambton College.
- The Sarnia plant will produce 30,000 tons of bio-based succinic acid per year.
- BioAmber Sarnia construction cost: approximately \$185.5 million CDN (US \$141.5 million).

For more information visit www.bio-amber.com.

From Spectators to Actors: The Growing Involvement of Sub-Nationals and Municipalities in the Climate Change Conversation

By Allister Hain

"IN PARIS," JEAN COCTEAU, the famous French writer and playwright once remarked, "everybody wants to be an actor; nobody is content to be a spectator."

This fall there's going to be lots of "actors" in Paris – climate change actors – who clearly will not be satisfied being spectators. More than 10,000 government representatives, another 14,000 civil society attendees and more than 3,000 media will gather

for two weeks at the 21st Conference of the Parties (COP21) on the UN Framework Convention on Climate Change (UNFCCC). Everyone will want to be heard.

Much like previous gatherings, the final negotiations will center on how and what national governments plan to commit to the fight against climate change. However, this time there seems to be a clear emerging belief that sub-national and municipal

governments and business have a profound and important role to play in climate change discussion and action.

Halldor Thorgeirsson, Director for Strategy at the UN Climate Change Secretariat, said as much earlier this year in a published speech to the Conference on Sustainable Innovation: "Negotiators are also considering how the new agreement can best capitalize on the dramatic mobilization of climate action at all levels of government, including local governments, and by all actors most notably corporations and investors."

We've Been Doing it All Along: Canadian Chemistry and Responsible Care®

In a recent publication from the United Nations Environment Programme (UNEP) "*Climate commitments of sub-national actors and business: A quantitative assessment of their emission reduction impact*," the global Responsible Care® initiative (with 152 companies) was identified as one, and oldest, of the initiatives which catalyse climate action.

In Canada, we've known for a long time the effect Responsible Care® has had on climate change mitigation and CIAC members have worked hard to reduce greenhouse gas emissions through operational efficiencies and product innovation. These results have brought significant results.

Since 1992, CIAC members have cut their carbon dioxide emissions by 35 per cent and reduced the global warming potential of their operations by 69 per cent. Individual members have made impressive strides.

NOVA Chemicals' move to using lighter, ethane-based feedstock at its Corunna, Ontario site is expected to reduce industrial GHG emissions by 25 per cent compared to 2010 levels. MEGlobal reduced its CO₂ emissions by 59 per cent by 2012 and they have already set new future thresholds. ERCO Worldwide now captures its hydrogen by-product as a zero-carbon, clean-burning fossil fuel substitute for its boilers which has resulted in a 94 per cent reduction in fossil fuel consumption at its Quebec facility and a 90 per cent cut to its carbon dioxide emissions.

Other members achieved equally good results through investment in new plants and technologies; improved emissions tracking; conversions to combined heat and power facilities; increased use of low-carbon fuels; and boiler and heater replacements and upgrades.

Changing Role of Sub-National Governments

At COP20 in Peru last year, more than 20 sub-national governments signed onto a special climate change initiative that potentially could unlock huge new climate change actions. These jurisdictions "have authority over key aspects of climate policy, including energy, transportation and the built environment," says the group's website. "As such, state and regional climate strategies have a critical role to play to mitigate and adapt to the impacts of a changing climate."

In Canada, earlier this year, the Government of Ontario introduced a new carbon pricing scheme. Other provinces such as British Columbia and Alberta are engaged in climate change consultations with their citizenry to build upon their existing carbon pricing mechanisms with the stated intention to bring something forward by the time the world meets in Paris.

Changing Role of Municipalities

Cities account for 70 per cent of greenhouse gas (GHG) emissions caused by human activities and with urban populations rising, cities will be the focus point for climate action for years to come.

In July 2015, 21 of Canada's big cities called for binding targets to reduce GHG emissions. The resolution committed them to support binding GHG targets that address both short-term and long-term commitments to reduce GHG emissions. It called on all members to develop and implement transparent and accountable risk identification and mitigation climate actions plans. Similar initiatives in other parts of the world are signaling a stronger willingness of municipalities to play in policy environments once reserved solely for national governments.

"Big cities have taken a leadership role by implementing practical environmental initiatives," says Edmonton Mayor Don Iveson. "We need other governments around the world to make similar commitments towards increasing energy efficiency, reducing reliance on non-renewable energy, and thereby reducing our greenhouse gas footprint."

What Does this Mean for Business?

The answer to that question could be summed up in one word: uncertainty. A global agreement on future climate action in an environment where sub-national governments and municipalities are going to play a larger role may mean increased uncertainty for businesses and corporations operating in those jurisdictions.

In Canada, with some provinces taking decidedly different routes than the federal government, an uneven policy and legislative landscape may emerge. Add in new demands from municipalities and a very patchy and confusing regulatory regime might be created.

New carbon pricing systems will also increase pressure on business. While some may see it as just another tax, first and foremost, any new system has to provide regulatory certainty and be in alignment with other jurisdictions and commonly used practices. Alignment provides regulatory certainty and mitigates impact on costs, competitiveness, regulatory processes, and trade.

Any new carbon pricing system should not penalize those businesses that have already made great strides towards carbon neutrality nor should it hamper those corporations that want to make new investments and create innovative new technologies that lead to a lower-carbon environment (see sidebar on opposite page).

Some experts suggest that an agreement in Paris will not, in and of itself keep the world below the two degrees of additional warming scientists say is necessary. They believe that if anything, the value of the

Paris consultations will be to define a broad pathway forward that defines a broader vision of what needs to be accomplished and paints a picture of how national and sub-national governments, municipalities, business and even individuals can take effective future climate action. If done right, it may just set the stage for collective, collaborative action and move the effort forward at a faster pace. •

Allister Hain is Director, Communications, Chemistry Industry Association of Canada.



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GreenCentre Canada Expands its Chemistry Innovation Services

By Andrew Pasternak, Ph.D., MBA

CONCEIVING AND IMPLEMENTING true innovation in the chemistry industry has always been a challenge for both large and small companies. Ideas are often plentiful, but developing these ideas to the stage where they can be considered commercially viable continues to be a challenge. Intellectual property issues and a lack of resources, financial support, and focus on current needs can all conspire to push innovation to the backburner. To address the innovation gap, GreenCentre Canada recently expanded its Innovation Services capabilities.

At GreenCentre Canada, we take a hands-on approach to developing chemistry and materials-science innovations originating from industry and academia.

Established in 2009, GreenCentre Canada is a designated Centre of Excellence for Commercialization and Research (CECR) with a mandate to assist in the development and commercialization of chemical technologies for both industry and academia. In the six years since its inception, GreenCentre has built significant expertise and resources for the development and commercialization of a wide range of novel chemistries and materials.

The Centre's capabilities include but are not limited to:

- evaluation and design of new chemistries;
- technology screening;
- focused application development;
- chemical process development (with a focus on sustainability);
- specialized chemical synthesis; and
- piloting of bench-scale chemical processes.

GreenCentre Facilities

GreenCentre operates two state-of-the-art facilities in Kingston, Ontario for the development of chemical technologies from small-scale all the way to large reactors. The 8,000 square foot laboratory is specially designed for small-scale, bench-top chemistry innovation and offers a full suite of

fume hoods, glove boxes (for air sensitive chemistry) and analytical instrumentation as well as several walk-in scale-up bays.

In addition, earlier this year GreenCentre announced a partnership with the Xerox Research Centre of Canada (XRCC) in Mississauga, Ontario, to access more than 40 years of expertise in commercial scale-up and pilot unit operations. The partnership includes use of XRCC's 24,000-square-foot pilot unit facilities with a wide range of reactors (up to 2,000 litres), processing equipment and separation/purification capabilities.

Serving Industry Better

At the highest level, GreenCentre offers its industry partners:

- product development from bench through pilot scale tailored to clients' specific needs;
- creation and protection of client intellectual property for commercially viable products; and
- supplemental R&D and product development with short-term, cost-effective outsourcing.

The Centre also serves two other industrial segments:

- 1. Early-stage, Ontario-based companies:** GreenCentre provides an extensive and practical range of sector-focused services at no cost or equity dilution to qualified early stage companies in Ontario. Services include product concept refinement, proof-of-concept and market analysis, product/process development, intellectual property support, and product launch services. Through the provincially sponsored ONE Chemistry Program, GreenCentre can offer this support to small- and medium-sized enterprises and entrepreneurs currently registered to do business in or intending to relocate/register operations in Ontario.
- 2. Established industry partners:** Often, larger and more established companies



wish to expand or improve current product lines through innovative chemistry technologies. However, development of these technologies can be risky and internal resources can be difficult to allocate to these types of projects. Working with GreenCentre allows companies to effectively de-risk these early-stage technologies in a milestone-based, collaborative relationship, with all advances kept confidential and proprietary to the industry partner. By supplementing a firm's internal R&D staff with short-term, cost-effective outsourcing, new technologies can be vetted, developed and brought to market in an efficient manner. GreenCentre continues to collaborate successfully with a number of large global corporations (including Fortune 500 companies) to develop new and innovative products.

An Online Innovation Portal

In addition to these hands-on chemistry services, GreenCentre has developed an internet-based portal – named InnovationHouse – to e-link industry with new technologies arising from academic institutions. Launched in September 2015, InnovationHouse will facilitate connections between industry and academic institutions for technologies that offer innovative solutions to open up new markets and products.

For further information visit: www.greencentrecanada.com.

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Notes from the 2015 TRANSCAER® Canada Tour

HENRI BOURQUE SPENT *the summer as an intern with the Chemistry Industry Association of Canada (CIAC) supporting the national TRANSCAER® program. He helped launch TRANSCAER® Canada on Twitter - @TRANSCAERCanada, participated in a number of training events and had the opportunity to meet some of TRANSCAER®'s leaders. Following are notes from his journal.*

May 29: I travelled to the Chlorine Institute sponsored event held in Bécancour, Quebec. Like most TRANSCAER® events, the training was comprised of classroom instruction in the morning and field demonstrations in the afternoon.

The event was held at the Olin Chlor Alkali plant, which sits on 175 acres of land between Montreal and Quebec City. The Olin company and its employees are practiced hosts and it showed in their organization and attention to detail.

I was impressed by the sophistication of the multimedia presentations in the morning. Representatives from Olin, Transport Canada and the Railway Association of Canada (RAC) covered their areas of expertise. The presentations were delivered in French, and simultaneously translated into English.

At this event I met Henry Ward, winner of the 2014 Distinguished Service Award, the highest level of recognition awarded by U.S. TRANSCAER®.

July 7: I attended the Assembly of First Nations Circle of Trade in Montreal. The yearly event is one of the largest gatherings of First Nations people and leaders and was broadly covered by the Canadian news media. It was a unique opportunity to spread awareness about TRANSCAER® to a new group of people who have not generally been involved with the program in the past.

Two of TRANSCAER®'s regional chairs attended this event – Jean Carpentier, Petromont (Quebec) and Randy Mak, Dow Chemical (Prairies/National). Both are great promoters of the program as longtime veterans of Responsible Care® and committed advocates of transportation safety.

We came away very encouraged from numerous conversations with Chiefs who had never heard of the program, but were interested and promised to discuss it with their fire chiefs or emergency response specialists. We were very pleased with our involvement in the trade show as we were able to discuss TRANSCAER® with more than 200 First Nations delegates.

July 15: I went to one of the first flammable liquids TRANSCAER® events held in Sault Ste. Marie, Ontario. This tour is the result of a new partnership between TRANSCAER®, the Railway Association of Canada, the Canadian Fuels Association and the Canadian Association of Petroleum Producers.

A diverse group came out to this event, including Sault Ste. Marie Police and Fire, as well as a contingent from the Ministry of



Randy Mak, National and Prairie Regional TRANSCAER® Chair and Jean Carpentier, Quebec Regional TRANSCAER® Chair at the AFN Circle of Trade in Montreal, QC, July 2015.



CIAC summer intern and author Henri Bourque (left) along with Michael Bourque, President of the Railway Association of Canada (RAC) and Andy Ash, Director, Dangerous Goods, RAC.

Natural Resources. Andy Ash, Director, Dangerous Goods, RAC, led the rail safety portion of this event. Andy is one of the longest serving TRANSCAER® trainers, with more than 15 years' experience.

There was noticeably more media coverage of this event with particular attention paid to the flammable liquids by rail element.

What was particularly impressive was despite the fact this was held in the middle of the summer vacation season, a significant number of first responders attended the event and stayed for each of the demonstrations to learn first-hand from the railways and other experts.

From these experiences, I have come to a number of conclusions. First, it takes a real commitment and team effort to organize and successfully host a TRANSCAER® event. There is a considerable amount of equipment that has to be moved (for example, for the Sault Ste. Marie event, CP moved their foam trailer from Thunder Bay for the one-day event). Experts from a number of organizations must commit to attending and their host organizations must financially support the effort.

Second, the information is well received and appreciated by first responders who share a real appetite for learning.

Finally, TRANSCAER® is an excellent expression of the Responsible Care® philosophy, which is rooted in doing the right thing and being seen to do the right thing. TRANSCAER® accomplishes both while bringing considerable credit to the sponsors, organizers and participants. ●

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“internalized” by regulations, stakeholder action or market dynamics and how this could affect future earnings.

For example, the implementation of a cap-and-trade system in Ontario or a further increase in the price on carbon in Alberta could increase energy costs for chemistry companies with plants in these provinces. Community and non-governmental organizations concerns about pollution around a key plant could halt production. Another possibility is extreme weather events delaying delivery and/or increasing the cost of raw materials.

Step 3. Develop a Business Case to Build Value

By assessing positive and negative externalities, Canadian chemistry companies can gain a new perspective on where they should invest for the greatest benefit to their financial returns, risk mitigation strategies, and societal value creation.

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To learn more download the KPMG International report, *A New Vision of Value: Connecting Corporate and Societal Value Creation* at www.kpmg.com/truevalue. ●

Arnaud van Dijk is a Senior Manager, Sustainability Services, at KPMG in Canada.

1 KPMG Expect the Unexpected, Building business value in a changing world (2012).



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SMARTPHONES: SMART CHEMISTRY

IF YOU HAVE ever dropped your phone without damaging the screen, you were probably relieved. Smartphone screens are designed to be extremely tough.

This toughness is the result of a serendipitous accident. In 1952, a chemist at Corning Glass Works was trying to heat a sample of glass to 600°C in a furnace when, unbeknownst to him, a faulty thermostat caused it to be heated to 900°C. Upon opening the door, he was glad – and surprised – to find that his glass sample was not a melted pile of goo and that it had not ruined the furnace. When he took it out with tongs, he dropped it on the floor (another accident). But instead of breaking, it bounced!

Thus was born the world's first synthetic glass-ceramic, a material that shares many properties with both glass and ceramic. Glass is an unstructured solid because it lacks a crystalline structure. The molecules are not in any kind of order but are arranged more like a liquid, yet they are frozen in place. Because glass does not contain planes (units) of atoms that can slip past each other, there is no way to relieve stress. Excessive stress forms a crack, and molecules on the surface of the crack become separated. As the crack grows, the intensity of the stress increases, more bonds break, and the crack widens until the glass breaks.

Ceramics, on the other hand, tend to be crystalline, and are often characterized by ionic (chemical) bonds between positive and negative ions. When they form crystals, the strong force of attraction between ions of opposite charges makes it difficult for one plane to slip past another. Ceramics are therefore brittle. They resist compression, but they can break when they are bent.

The combination of glass and ceramic forms a material that is tougher and stronger than each of the materials by themselves. A glass-ceramic is formed by overheating the glass, so a portion of its structure is transformed into a fine-grained crystalline material.

As a result of the success of glass-ceramic materials, the Corning Glass Works Company undertook a large research effort to find ways to make ordinary transparent glass as strong as glass-ceramic products. By 1962, Corning had developed a very strong type of chemically strengthened glass, unlike anything ever seen before. This super-strong glass would eventually make its way to nearly every Smartphone screen. It is so strong it goes by the name, Gorilla Glass. Tests have shown that Gorilla Glass can withstand 100,000 pounds of pressure per square inch!

Gorilla Glass is composed of a chemical compound of silicon and aluminum – also called aluminosilicate glass – along with sodium ions. It gains its tremendous strength through one final step, in which the glass is chemically strengthened. The glass is put into a molten bath

of potassium salt, usually potassium nitrate, at 300°C. Because the potassium ions are larger and more reactive, they displace the sodium ions, take up more space in the glass than do sodium ions.

Cramming larger ions into the spaces formerly occupied by smaller ions results in a compressing of the glass. Consider this analogy to visualize the process: The world record for the most people crammed into a Volkswagen Beetle is 25. These were most likely small people. Now imagine replacing these 25 small people with 25 NFL linebackers, each weighing in at 350 pounds. To squeeze such large men into such a small space would require a fair amount of compression. Compression will always try to make things smaller.

In the same way, as the larger potassium ions push against each other, the glass is compressed. Compressed glass is very strong. As a result of this compression, a lot of elastic potential energy is stored in the glass, much like the elastic potential energy that you might find in a compressed spring – making a Smartphone screen resistant to – almost all – daily wear and tear.

Excerpt reprinted with permission from *Smartphones: Smart Chemistry* by Brian Rohrig published in the April/May 2015 issue of *ChemMatters* online.



The road to your Smartphone took many turns, some unexpected, some revolutionary – all of which lead to you being able to drop your phone without shattering.

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CIAC WELCOMES TWO NEW MEMBERS



Chemours™

On Aug. 1, **The Chemours Canada Company** joined the CIAC membership.

This global company, with 97 locations around the world, is composed of three business units: titanium technologies, fluoroproducts and chemical solutions. Chemours' Canadian operation is centred on fluorochemical production, and is based in Maitland, Ontario. For more info, visit: www.chemours.com/our-company.



Golder Associates

Also on Aug. 1, **Golder Associates Ltd.** joined CIAC as an Associate Member. Founded in 1960, Golder is an employee-owned, Canadian-

led company of 7,000 people, with 180 offices worldwide. The company provides solutions that help the chemistry industry achieve its Responsible Care® objectives through a wide range of independent engineering and scientific consulting, design and construction services in areas of earth, environment and energy. For more info, visit: www.golder.ca.

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