Chemistry Industry Association of Canada

Alberta Members' CEP Plan Update

Alberta's Chemical Sector: Adding Value to Resources

Sector Water Usage & Opportunities for CEP:

Conservation, Efficiency & Productivity

Update 2015

Table of Contents

1.0 Overview of CEP Sector Plan

Water is a critical component of life; we rely upon it to support all living beings and virtually all activities, including maintaining human health, conserving wildlife habitat, producing food and for industry and transportation. The chemistry industry is no different, in that it utilizes water for numerous and necessary purposes in industrial processes and operations.

The chemistry and petrochemical CEP plan focuses on province-wide water use by the chemistry sector, and identifies which steps the industry has taken towards responsible water use while simultaneously looking at future opportunities for conservation, efficiency and productivity. Consistent with Alberta's *Water for Life* strategy, our industry sector understands and supports the need for the supply of reliable, high-quality industrial water. Further, our sector recognizes responsible water usage as a prerequisite for a sustainable economy, for safe and secure drinking water for all Albertans, and for the maintenance of healthy aquatic ecosystems.

1.1 Goals and Objectives of CEP Sector Plan

Water use in the chemistry industry involves withdrawing water from the source and transporting it into the facility, then cleaning and treating it to render the water suitable for use in chemical processes. Subsequently, chemistry facilities treat wastewater prior to discharging effluent to the receiving environment.

Treatment of raw water for process use, as well as the subsequent re-treatment of the wastewater prior to discharge, is a complex and exacting activity requiring significant energy and investment.

As recently as a half-century ago, abundant supplies of cheap, clean water were taken for granted and processes were generally designed with little thought to the consequence of use. Today, it is clear our appreciation of this essential resource has grown, and brief periods of drought have reminded us sharply that water conservation and greater efficiency of its use must be part of our planning and performance in our collaborative stewardship of natural resources.

Notably, and especially over the last 20 years, the chemistry sector has expended considerable effort finding ways to reduce water, energy and other resource use, in order to become more efficient through enhanced productivity.

Performance measurement is the key metric to track progress toward targets, and with that evidence in mind, the sector welcomes accountability and demonstrates commitment to goals and objectives. CIAC has now published its annual *Reducing Emissions* report for over 20 years, outlining and reinforcing its commitment to Responsible Care.

This report is shared openly and publicly via the CIAC website.

The goals of the *Chemistry Sector CEP Plan* are the continuous reduction of the volume of water used, and to continually do our part to preserve and conserve water in Alberta. Additionally, the plan will document individual companies' successes in efficiency measures, either large or small. If the chemistry sector can increase production capacity significantly, we will show how the industry has been able to enhance productivity (i.e., volume or weight of product per cubic metre of water used). The objective is to demonstrate and document positive results in implementing all three aspects of CEP.

1.2 Scope of Plan

At the outset, we acknowledge the fact that this sector plan does not cover all of the industrial water users considered to be chemical or petrochemical facilities. Specifically, the plan covers CIAC member companies in Alberta, and represents the majority of large facilities in the province. For example, water usage by the fertilizer industry, represented nationally by the Canadian Fertilizer Institute (CFI), is not included. This document represents the *CEP Plan for CIAC*, and is independent from any other sector plan.

Although the Alberta Water Council recognizes the overall water use by the chemical and petrochemical sector is relatively small, the usage is ultimately concentrated in specific watersheds whereby the impact of this resource draw may, in fact, be quite significant. This localized requirement may increase with the potential industry growth forecasted over the next 10-15 years, since "clusters" of facilities provide additional efficiency options for the companies involved.

1.2.1 Chemistry Industry Association of Canada

Canada's chemistry industry transforms raw materials like natural gas liquids, oil, minerals, electricity and biomass into the building blocks needed to manufacture some 70,000 consumer products, upon which everyone depends daily. Vehicles, electronics, textiles, building materials, paper and pharmaceuticals all exist largely due to the power of chemistry.

The Chemistry Industry Association of Canada is the voice of Canada's business of chemistry. CIAC represents more than 30 companies and Responsible Care partners operating in the chemistry industry, ranging from just five to over 5,000 employees.

CIAC was created in 1962 and renamed in 2009 to better reflect the changing nature of this dynamic industry. By 1985, the association adopted Responsible Care as its operating ethic, and has published detailed annual industry emission data to the public in its *Reducing Emissions* reports since 1992.

CIAC has three main objectives:

- Be credible
- Be responsible
- Be competitive

Through these objectives and governance by an active membership, CIAC has developed a strong reputation as a pragmatic, policy-based and innovation-oriented organization. It represents members' interests based on solid analysis, while working cooperatively with government and other groups to create a future benefitting both Canadian society and the nation's chemical industry. CIAC represents members' interests on a range of issues: access to raw materials, energy, transportation, taxation, trade, and regulatory efficiency, to name a few. Additionally, we work with government~~s~~ to foster a competitive business climate for Canada's chemistry industry, and to raise the public's confidence in chemicals management.

Our chemistry industry is currently poised for growth, with the potential to attract up to CDN$10 billion in new investment by 2025. Through CIAC's commitment to Responsible Care, our industry will ensure growth isn't generated at the expense of Canadian citizens' health or environment.

To Alberta, chemistry is essential to the foundation of a prosperous province. This CDN$14 billion chemistry industry creates jobs, adds value to natural resources, and supports Alberta's diversified economy. Almost every sector in Alberta, from oil and gas to construction, relies directly upon the chemistry industry's products.

Consequently, each job in Alberta's chemical manufacturing sector creates five more jobs elsewhere in the province, with our industry directly employing 7,550 Albertans and supporting another 38,000 jobs throughout the province. World-scale manufacturing facilities generate enormous volumes of product, thus requiring a strong logistics infrastructure to transport them to market. The chemistry sector accounts for a very significant portion of the Alberta export market, and is a stable, long-term community supporter and provincial employment asset.

CIAC membership in Alberta varies from smaller distribution centres of large multinational companies, to large petrochemical complexes with several world-scale manufacturing facilities. Several of our member companies provide important services to other industry sectors such as oil sands and oil and gas. Carbon-based organic chemistry products account for a large portion of the sector's products, while several member companies focus on inorganic products, such as water treatment chemicals. Consequently, the products and services of chemistry are among the most varied of any industry sector.

Since chemical manufacturing reflects a value-added chain wherein the product of one facility becomes the feedstock of the next, or the by-product that can be used by an adjacent facility, this inherent chain has resulted in the development of chemical manufacturing clusters. This structural scenario has enabled the development of huge chemical manufacturing clusters globally, with more modest versions in Alberta. For example, the Joffre and Fort Saskatchewan areas represent chemical manufacturing clusters on a relatively small scale, yet still realize desirable benefits. The synergies of such clusters have significant utility benefits, including shared water and wastewater treatment, and often have a markedly lower environmental impact than does a collection of individual facilities.

CIAC member company activities encompass both petrochemical and inorganic chemical manufacturing. Albertan petrochemical facilities take ethane (natural gas liquids) as feedstock and crack the ethane into ethylene in high-temperature furnaces. In turn, the ethylene produced allows the production of a varied suite of important substances and products upon which we depend every day. Inorganic chemical manufacturing uses a variety of feedstock such as acids and salts, while electricity is the key feedstock component within the electrochemical industry.

As members of CIAC, Alberta's chemistry companies have committed to Responsible Care, our UN-recognized sustainability initiative. Responsible Care compels companies to innovate for safer, more environmentally-friendly products and processes, and to eliminate harm throughout the entire life cycle of their products.

1.2.1.1 Responsible Care™

The Responsible Care initiative is the Canadian chemistry industry's most outstanding achievement. It was established in 1985 to address public concerns about the manufacture, distribution and use of chemicals following a number of chemistry-related incidents, one of the most notable being the 1984 chemical release in Bhopal, India. Since its inception, Responsible Care has guided the chemistry industry to do the right thing and be seen to do the right thing, in Canada and in 60 other countries.

In 2008, the Canadian Responsible Care Codes and expectations of member companies were reviewed, in order to further stimulate continuous improvement by making sustainability its driving force.

Responsible Care is the chemistry industry's commitment to sustainability, with direct focus on the betterment of society, the environment and the economy. Its ethic and principles compel companies to innovate for safer and more environmentally-friendly products and processes, and to work cooperatively to identify and minimize – or eliminate – harm throughout a product's life cycle.

Responsible Care represents commitment to continuous improvement of all aspects of the chemistry industry's environmental health and safety performance and its open, ongoing dialogue with stakeholders about activities and achievements. Responsible Care also covers every aspect of a member company's business, including environmental protection, resource conservation, occupational health and safety, process safety, research and development, transportation, product stewardship, purchasing, security and social responsibility. It requires engagement with plant-site neighbours, communities along transportation corridors, advocates and critics, as well as governments at every level, in order to advance laws and regulations in support of sustainability.

Responsible Care distinguishes itself from other environmental management systems because it is an ethic, which encompasses a value shift in corporate approaches to stakeholder engagement. It is reflected in responsible actions throughout the organization and within efforts to maintain and enhance awareness and credibility, while simultaneously being competitive in the global economy.

A third-party independent verification process is a core requirement of Responsible Care. The verification serves to assure member companies and the public that the ethic and practices of Responsible Care are in place and indeed driving continuous improvement. Every three years, companies are verified by teams of industry experts, public advocates and local citizens who write a consensus report summarizing the verification process and players, opportunities for improvement, findings requiring corrective action, and, of course, successful practices. Once the team has successfully completed their task (with repeat visits as necessary), the company is presented with a verification certificate. Verification reports are made available to local communities and other interested parties by the verified company and on CIAC's website – *canadianchemistry.ca*.

1.2.2 CIAC Member Companies in Alberta

The membership of CIAC is continually changing. As of October 2015, the Alberta membership of CIAC includes the following companies:

BASF Canada

Blackie – This location manufactures rigid polyurethane systems, which include products such as BASF's WALLTITE polyurethane foam insulation/air barrier system. As a bulk distribution hub for polyurethane raw materials, the site also services the wood binding and fertilizer markets in Western Canada. It currently operates with seven employees. The site routinely or frequently engages in dialogue with neighbours and local community members as part of the site's Responsible Care commitment.

Nisku – Here, concrete admixtures are formulated that improve specialty concrete through placing, pumping, finishing, performance, and appearance. Specialty concrete is used in the ready-mix, pre-cast and manufactured concrete products, underground construction, and paving markets. Products are typically shipped to customers in bulk tankers. The facility serves customers in the western provinces and in western Ontario. The Nisku site joined BASF Canada in 2006 as part of BASF SE's acquisition of Degussa's global construction chemicals activities. The site is committed to BASF Canada's Responsible Care philosophy and culture, by participating in the prioritizing of safety, health and environmental protection within its daily business activities.

Chemtrade Logistics operates a diversified and world-leading business providing industrial chemicals and services. In North America, Chemtrade owns a total of 62 production facilities covering virtually every region with its operations and sales. Chemtrade utilizes its extensive sales force in tandem with its distribution network to connect with customers in almost all industries. It has two production facilities in Fort Saskatchewan, from which aluminum sulphate (alum), sodium bisulphate, carbon disulphide and hydrogen sulphide are produced, and a customer service centre for the storage of sulphuric acid.

Chemtrade also owns and operates a portion of the environmental compliance facilities at the Syncrude Canada coker. Through its proprietary technology and a waste ammonia stream, Chemtrade's system scrubs contaminants from the emissions and produces a value-added by-product – granular ammonium sulphate fertilizer.

CCC Group is one of the largest independent distributors in Canada, and the tenth-largest distributor in North America. Founded by Mr. R.R. Carr-Harris in 1920, the company's growth over many years has been built on strong customer service, quality assurance and Responsible Care. The company's distribution services span Canada with warehouses located in Brampton, Windsor, Montreal, Vancouver and Leduc. Additionally, there is a sulphuric acid manufacturing plant in Elmira, Ontario, and a colour concentrate plant in Colborne, Ontario.

The Leduc site, located in central Alberta just east of the QE II Highway, opened in 1998. This site provides a full range of services for industrial chemicals and blending to a wide range of industries, as well as toll blending services for oilfield chemicals. Liquid chemicals are shipped within drums, tote tanks and bulk tank trucks. The facility has gone through a number of expansions, with the latest investment bringing its size up to 63,000 f^2 (which includes an off-site 30,000 f^2 warehouse), as well as adding significant blending capacity and rail-to-truck trans-loading capability.

Dow Chemical Canada ULC

The Dow Chemical Company combines the science of chemistry with human ingenuity to improve quality of life for billions of people. In Canada, Dow makes basic chemicals and plastics that are the ingredients for many finished products used globally on a daily basis. For example, the people of Dow Canada help make homes warmer, shoes more durable and food fresher.

Fort Saskatchewan – Surrounded by an abundance of natural resources, Dow's Fort Saskatchewan manufacturing facility is the company's largest petrochemical manufacturing site in Canada. The 2,128-acre site is home to three world-scale Dow manufacturing plants, plus one MEGlobal plant that utilizes the area's natural resources to make basic chemicals and plastics.

Prentiss – This manufacturing location is one of the three sites comprising Dow Canada's Alberta Operations. Located in the heart of the province near Red Deer, Prentiss is home to a Dow-operated polyethylene plant, and two world-scale ethylene glycol plants operated by MEGlobal. MEGlobal manufactures markets and supplies ethylene glycol worldwide. Additionally, Dow has 50-percent-ownership of the E3 ethylene cracker in Joffre, Alberta, which is operated by NOVA Chemical Corporation.

Sturgeon County – Dow AgroSciences Fort Saskatchewan F&P facility is located on 40 acres of rail-serviced industrial land in the Sturgeon Industrial Park. This facility formulates and packages a granular herbicide, and also repackages glyphosate liquids for the western Canada region.

ERCO Worldwide generates its major global business stream as a chemical producer with chlor-alkali, a product serving many industries, from municipal and industrial water treatment to food processing, agricultural intermediates, and oil and gas. ERCO is also North America's third-largest producer of potassium products.

The Grande Prairie site produces sodium chlorate, a raw material for the production of chlorine dioxide, an environmentally-preferred bleaching agent supplied to the pulp and paper industry. ERCO is the second-largest producer of sodium chlorate in North America and the world, while hosting the largest installed base of modern chlorine dioxide generators and related technology on the globe.

More than two decades' worth of chemical plant operation in Grande Prairie have been noteworthy for ERCO. Since 2005, the site has been recognized by Alberta Environment and Water as an *EnviroVista Leader* – one of just a few facilities honored for outstanding performance exceeding the expectation of Alberta's environmental legislation, while demonstrating responsibility, stewardship and an ongoing commitment to environmental performance improvements.

Evonik is a creative industrial group and market leader in the specialty chemicals industry. This Germany-based company employs more than 33,000 people in over 100 countries and generates sales of almost €13 billion. The Canadian subsidiary of Evonik Industries began production in 1991 in Gibbons, Alberta, and is now one of North America's largest hydrogen peroxide (H_2O_2) production facilities with an annual capacity of more than 90,000 tonnes. The site currently employs almost 50 people.

An extremely clean and versatile chemical, hydrogen peroxide is used for oxidation reactions, bleaching processes in pulp, paper and textile industries, wastewater treatment, exhaust air treatment and for various disinfection applications.

All of this is possible due to Evonik's strong commitment to its neighbours and environment through Responsible Care, and its corporate policies and practices. Focusing upon health, nutrition, resource efficiency and globalization, Evonik benefits specifically from its innovation prowess and integrated technology platforms. The Gibbons site has particularly benefitted from reaching a remarkable safety milestone in 2015 – employees have worked 12 years without a lost-time accident, pertaining to work-related accidents or injuries.

INEOS Oligomers, the world's largest producer of low viscosity polyalphaolefins, operates five manufacturing sites globally – Belgium, France, Germany, Texas (USA) and Joffre in Alberta.

The plant at Joffre, east of Red Deer, began operating in 2001. A quarter-million metric-tonne-per-year facility, it incorporates global-leading proprietary technology in LAO production. The site is adjacent to the NOVA Chemicals petrochemical complex, which provides various utilities and services for the LAO plant. In 2014, a de-bottleneck project was completed at the site.

LAOs are used in the production of polyethylene, as intermediates for the manufacture of linear plasticizers for polyvinyl chloride, as raw material to manufacture polyalphaolefins for synthetic lubricants, as a building block for the production of biodegradable surfactants, and for a host of other intermediate and final products.

MEGlobal

Established in 2004, MEGlobal is a joint venture between The Dow Chemical Company of the United States, and Petrochemical Industries Company (PIC) of Kuwait. MEGlobal manufactures more than 1 million metric tonnes (MT) of ethylene glycol per year at its three manufacturing plants in Alberta.

In addition, MEGlobal markets in excess of 3.5 million MT of ethylene glycol from its world-leading supply partners. EG is a key raw material used in a wide variety of products and applications including the manufacture of polyester fibers, polyethylene terephthalate resins (PET), antifreeze formulations and other industrial products. EH&S is the number one priority for MEGlobal employees, customers and communities. In all its locations around the world, MEGlobal is committed to the principles of Responsible Care, and strives for *Target Zero*.

Fort Saskatchewan – This FS1 EO/EG (ethylene oxide/ethylene glycol) plant, begun in 1961, is now home to approximately 45 employees. The plant is one of the largest in Canada, producing more than 380,000 MT of glycol per annum.

Prentiss – MEGlobal operates two plants at this site near Red Deer, home to approximately 100 employees. The Prentiss I EO/EG plant started up in 1984, while the Prentiss II EO/EG plant started up in 1994. Each plant has a capacity of 320,000 MT of glycol per annum.

Locally-committed and globally-extended **Methanex** is the largest producer and supplier of methanol to major markets in the North and South Americas, Asia-Pacific and Europe. Its production facility in Medicine Hat supplies methanol primarily to markets in western Canada and the northwestern US. This Albertan plant, with an annual capacity of 560,000 tonnes and over 120 highly-skilled professionals plus additional local contractors, is but one of Methanex's many strategically-positioned production sites reinforced by an extensive global supply chain able to deliver a ready supply of methanol.

Globally, the workforce of almost 1,100 employees weaves *The Power of Agility*™ into the company's competitive advantage and ongoing expansion planning. Part of that agility translates into taking an active role in the social and cultural development of Medicine Hat through a range of social responsibility investment programs. This brand promise, with respect to adapting to customers' needs and to social engagement, has resulted in numerous awards for Methanex's commitment to Responsible Care and overall social responsibility within North America.

Nalco has been doing business in Canada for nearly 70 years. Nalco is the leading provider of integrated water treatment and process improvement services, chemicals, and equipment programs for industrial and institutional applications. Nalco's commitment to improving the quality of their customers' products and positively impacting their operations drives the company to a high-level of innovation. Nalco will continue to focus on meeting and exceeding the needs of their customers.

National Silicates is a wholly-owned Canadian subsidiary of the PQ Corporation (the first non- US subsidiary) and has been serving customers in Canada since 1931. PQ Corporation is a leading world-wide producer of specialty inorganic performance chemicals and catalysts, and the world's largest producer of soluble silicates.

Headquartered in Toronto, Ontario, National Silicates has production and distribution facilities for sodium and potassium silicates in Valleyfield, Quebec; Toronto and Fort Frances, Ontario; Whitecourt, Alberta; Surrey and Parksville, British Columbia. National Silicates produces various types of sodium and potassium silicates and liquid magnesium sulphate. The Whitecourt site was established in 1988 for the production of sodium silicate. In 2007, an expansion for the addition of a potassium silicate process was completed. Material is delivered by truck.

NOVA Chemicals employs over 700 people at their Joffre manufacturing facility situated just east of Red Deer, Alberta, and is one the largest ethylene and polyethylene production complexes in the world. The site actually consists of five manufacturing facilities: three for ethylene production and two for polyethylene production. Joffre's first ethylene plant started production in 1979, becoming the first manufacturing facility built by NOVA Chemicals. A second ethylene plant and a polyethylene plant both began production in 1984.

In 2000, NOVA Chemicals started up a third ethylene plant, as part of a joint venture with DOW Chemicals, nearly doubling Joffre's ethylene production by taking it to 2165 kilotonnes annually. At the same time, NOVA Chemicals began production in a second polyethylene plant with an annually-rated capacity of 390 kilotonnes. In order to power the expanded Joffre facility, NOVA Chemicals and several partners built a 450-megawatt gas-fired cogeneration facility in conjunction with these significant site additions.

Since 2009, NOVA Chemicals Joffre site has been recognized by Alberta Environment as an *EnviroVista Leader*, one of only a few Alberta facilities honoured in recognition of outstanding performance exceeding the expectations of the province’s environmental legislation and demonstrating responsibility, stewardship and an ongoing commitment to improving environmental performance.

Shell Chemicals Canada operates in Scotford, only a few kilometres northeast of Edmonton. This site, established in 1984, combines chemical production with the first refinery to exclusively process synthetic crude oil from Alberta’s oil sands. Also efficiently positioned is the adjacent upgrader, which converts bitumen from the Shell Albian Sands to synthetic crude. The Scotford site produces styrene monomer and monoethylene glycol (MEG) in addition to its full range of fuels for the Western Canadian market.

As part of the production of fuel products, the refinery sends the by-product benzene to the chemicals plant to produce styrene monomer, a critical component of many wide-ranging consumer products used in enormous quantities year-round. The mono-ethylene glycol (MEG) plant was added to the refinery/chemical plant mix in 2000. By 2006, the facility started up the first diesel hydro-treater in western Canada to meet the new federal Ultra-Low Sulphur Diesel regulations. Currently, more than 450 full-time employees and 200 long-term contractors comprise the Scotford workforce.

The last CEP report submitted by the chemistry sector included companies now formerly of the CIAC membership. These companies include Celanese and Newalta. Conversely, CIAC has another member, Methanex, whose production facility had been shut down at the time of the last report, has since re-started the production unit in Medicine Hat.

1.2.3 Member Company Water Use Clusters

North Saskatchewan River Basin – This is the largest cluster of chemistry sector water users in Alberta and includes the larger water users. These users are, namely, Dow Chemical Canada ULC (Fort Saskatchewan), MEGlobal operating on the Dow Canada site (Fort Saskatchewan), and Shell Chemicals (Scotford).

There are several other CIAC member companies operating within the North Saskatchewan River basin, including Chemtrade (Fort Saskatchewan), Evonik (Gibbons), National Silicates, CCC Group, BASF, and Nalco. Many of these members are relatively low-volume water users who primarily rely upon municipal water supplies for these sites.

Red Deer River Sub-Basin – The next-largest cluster occurs in the Red Deer River sub-basin, which includes the MEGlobal/Dow site in Prentiss, as well as the NOVA Chemicals/INEOS site in Joffre.

Peace/Slave Lake River Basin – ERCO Worldwide in Grande Prairie.

South Saskatchewan River Basin – Methanex in Medicine Hat.

1.3 The Case for Water CEP

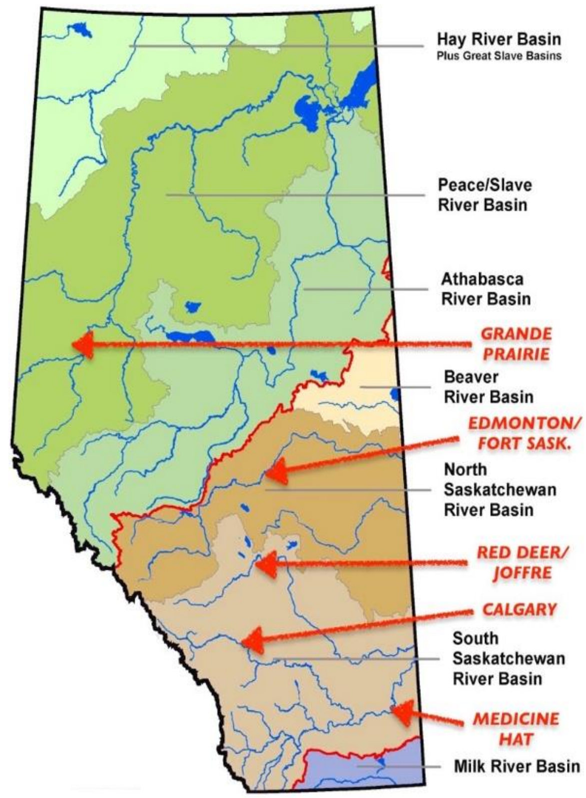
The key case for CEP in the chemistry sector is actual demonstrated commitment to the practice of sustainability. In 2010, CIAC integrated sustainability into Responsible Care. Since Responsible Care compels companies to use all resources sustainably, CEP plans provide a way to document Responsible Care in action, with respect to the use and stewardship of Alberta's water resources.

1.4 CEP Plan Champion and Leaders

Individual member companies are ultimately responsible for implementing CEP plans. Through these plans, senior company executives are accountable for their company's ongoing performance to the regional Leadership Groups. During the tri-yearly independent verification process, companies are required to demonstrate their commitment to the Responsible Care ethic and to the expectations of the Responsible Care Codes of Practice.

2.0 Profile of Existing Water Systems

As shown on ***Map 1*** to the right, the three main water systems providing the majority of water supply to chemistry sector facilities are the North Saskatchewan, the South Saskatchewan, and the Peace/Slave river basins.



The North Saskatchewan River Basin covers about 80,000 km^2 of Alberta. The basin begins in the icefields of Banff and Jasper national parks and generally flows in an eastward direction toward the Alberta-Saskatchewan border. The Brazeau, Nordegg, Ram, Clearwater, Sturgeon and Vermilion rivers flow into the North Saskatchewan River within Alberta. There are two large dams located in the basin: the Big Horn Dam on the North Saskatchewan River which creates Lake Abraham, and the Brazeau Dam on the Brazeau River, resulting in the Brazeau Reservoir. Major urban and industrial centres within the basin include Drayton Valley, Edmonton and Fort Saskatchewan. The mean annual discharge from the basin in Alberta into Saskatchewan is over 7,000,000,000 m^3.

The South Saskatchewan River Basin includes the sub-basins of the Bow, Red Deer, Oldman and South Saskatchewan rivers. All of the basins begin in the Rocky Mountains, generally flowing eastward through foothills and prairie. The combined watershed of the basins is 121,095 km^2, of which 41% is from the Red Deer sub-basin, 22% from the Oldman, 21% from the Bow, and 16% from the South Saskatchewan. Major urban and industrial centres in the basin include Calgary, Lethbridge, Red Deer, Joffre and Medicine Hat. All of the province's 13 irrigation districts are found within the South Saskatchewan River Basin. The mean annual discharge from the basin into Saskatchewan is 9,280,000 m^3.

The Peace/Slave River Basin includes the Wapiti, Smoky, Little Smoky and Wabasca rivers. The Peace River begins in the mountains of British Columbia, where its flows to Alberta are influenced by BC’s W.A.C. Bennett Dam, located upon the Peace River. The river flows north-eastward across Alberta, through the town of Peace River, whereupon it empties into the Slave River. The main urban areas within the basin are High Level, Peace River and Grande Prairie. At Peace Point, the Peace River has a mean annual discharge of 68,200,000 m^3, and a drainage area of 293,000 km^2.

2.1 Water Use Profile

As made evident from ***Table 1***, below, most of the facilities use fairly small volumes of water in the course of business activity. The larger chemistry sector hubs in Alberta are located primarily in two main geographic areas: the Fort Saskatchewan area, with the North Saskatchewan River as the primary water source, and the Joffre/Prentiss area with the Red Deer River as the primary water source.

TABLE 1
2015 Profile of CIAC Water Users in Alberta

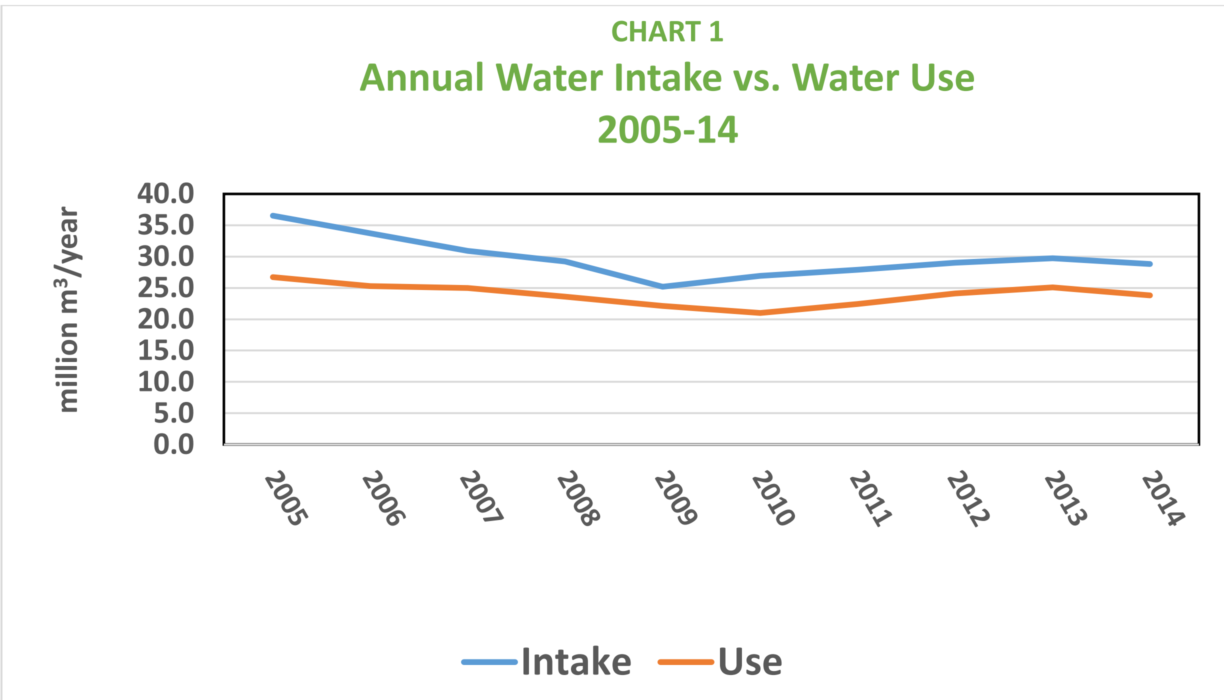
WATER USED (m^3/year)	# OF FACILITIES	COMPANIES	WATER SOURCE/S
>10k	5	Dow Ag Sciences BASF (2) CCC Group Nalco	*EITHER* zero (0) usage *OR* municipal sources
11–25k	2	National Silicates Chemtrade	Municipal sources
26–100k	3	NOVA Calgary Chemtrade (2)	Municipal sources
101–999k	3	ERCO INEOS Evonik	Surface
>1 million	4	Dow MEGlobal (2) Methanex	Surface – MEGlobal & Dow Municipal/aquifer – Methanex
>3 million	3	Shell Dow NOVA	Surface

2.1.1 Physical Characteristics

Chemical facilities generally operate continuously unless a scheduled maintenance or equipment failure disrupts the operation. Because of this continuity, water use variation is neither high nor is it dependent upon seasonality. Significant variations are more reflective of major plant turnarounds, or for low operating rates to accommodate over-supply and/or low commodity demand. Summer temperatures naturally account for greater cooling water requirements; however, this variation is relatively insignificant overall. Still, due to the size and complexity of the facilities, some units are likely to continue operating even when one unit within the facility is shut down, thus maintaining some water use requirements.

2.1.2 Baseline Water Use

The chemistry sector water usage is provided as a net value in cubic metres (m^3) per year. Storm water, or surface runoff, is collected and treated differently by individual companies, as some companies incorporate it into their overall site water supply and others do not. As well, any chemistry facility using less than 100,000 m^3 per year is not aggregated into the sector water use summary. These smaller chemical facilities mostly rely upon municipal water supply and water treatment facilities, and constitute a minor portion of the sector water use. Consumption made in this way is also aggregated into municipal reporting.



As made evident in ***Chart 1***, above, the water intake and consumption for the chemistry sector has remained largely flat for the reporting update period of 2012-14. For all chemistry sector water users of more than 100,000 m^3 per year, the aggregated average annual intake is 29,800,000 m^3 (from 2005-14). The aggregated average annual consumption for the same user group and the same time period is 23,900,000 m^3.

The decrease in intake/consumption during the period of 2005-10 is mostly attributable to two events: the shutdown of some operating units and the economic downturn of 2008-09. Economic conditions at this time forced plants to operate at lower rates than capacity.

Monthly water usage variation for facilities within the sector is not high (refer to data in the *2012 Chemistry Sector CEP Plan*). Fluctuations are mostly attributable to summer increases in cooling requirements, or from plant turnarounds or outages.

In some cases, where there is proximity to other industrial operations, chemistry sector companies can provide a utility service to adjacent facilities, and not necessarily another chemical sector facility. Similarly, the chemistry sector member facility may source its water supply from another member or a non-chemistry sector operation.

2.1.2.1 Correlation of Water Use with Productivity

Since products generated by the chemical sector are quite varied, it is difficult to find a common denominator that allows accurate correlation of water use to productivity.

A generally-used indicator is a comparison of the dollar value of chemical exports from Alberta versus water intake by chemistry facilities in Alberta.

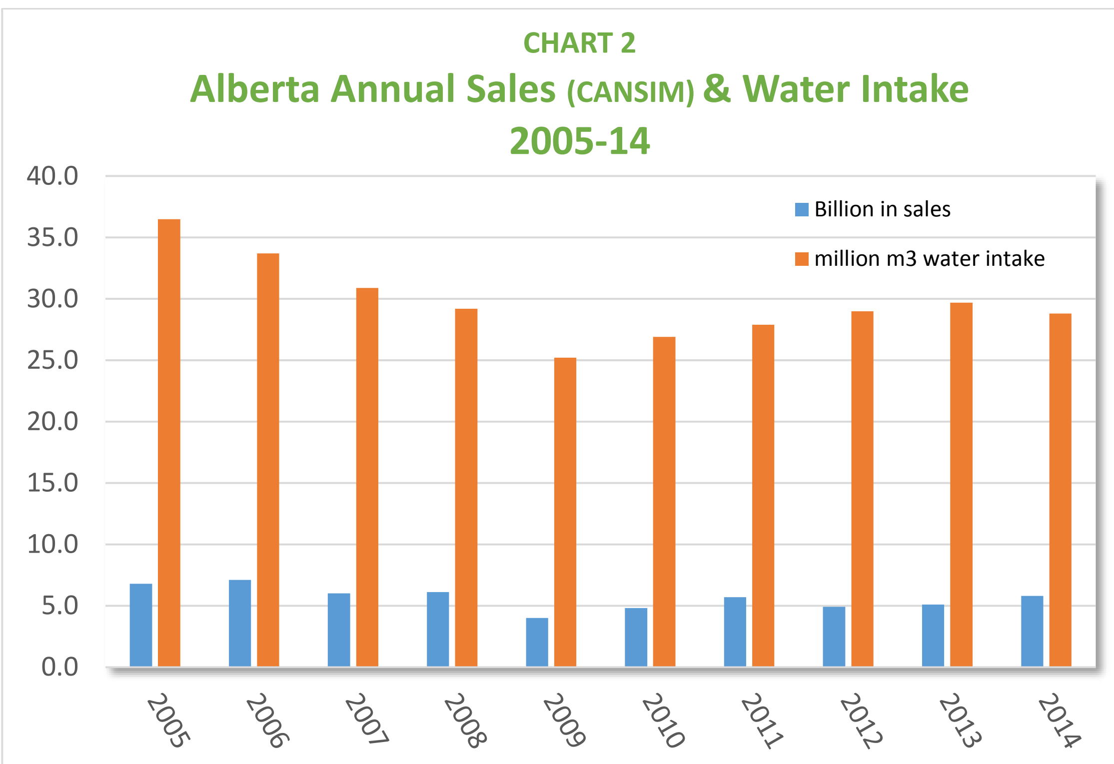
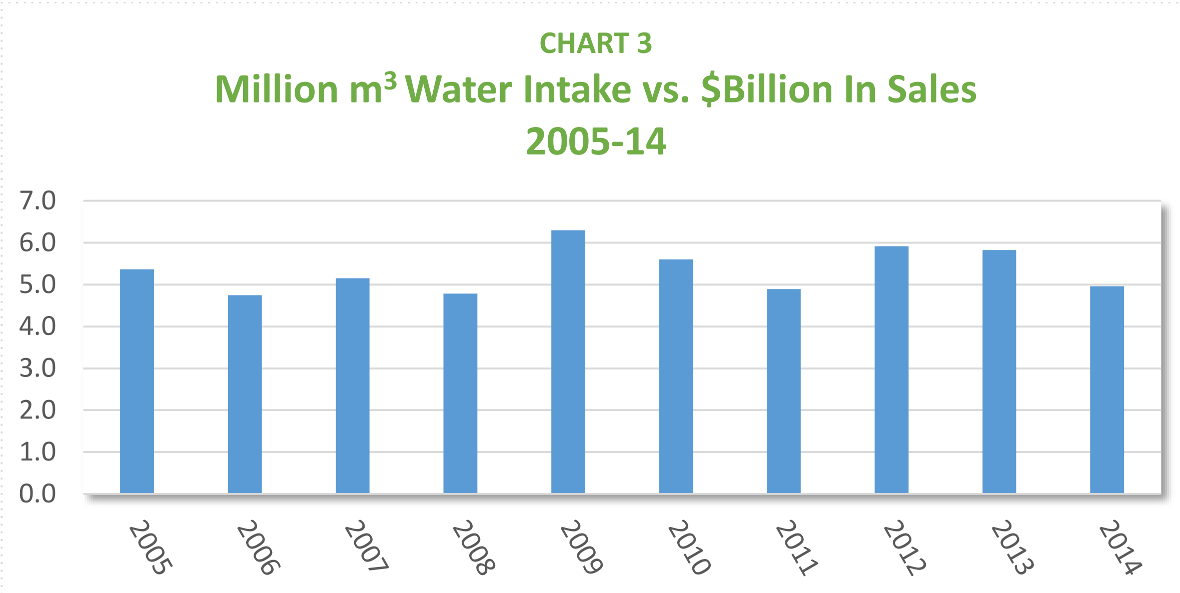


Chart 2, above, shows the Albertan annual sales value of NAICS 3521 (basic chemicals from CANSIM) versus the reported water consumption from CIAC companies.

Shown in another way – ***Chart 3***, below, indicates the ratio of water intake (in million m^3 per year) versus the Alberta annual sales figures for NAICS 3521 (basic chemicals) in billions of dollars.



Currently, this indicator is the most easily-calculated measure available, as most data collected by government statistics agencies is published in dollars. This relationship of sales value against water consumption can be misleading in the short-term due to the fluctuating nature of commodity prices, however over the long-term, the correlation may attain more validity.

2.1.3 Description of Key Water Uses

In the chemistry sector, water use falls into three primary areas, as:

- boiler feedwater that creates steam for use in the process, and as a motive force
- component of chemical reaction that forms the desired product
- cooling water make up in either once-through or recirculating cooling towers

Steam is a key component of chemical manufacturing. Raw water, drawn from a river or other surface source, must be highly treated in order to produce water of a suitable purity for use in the process. This purification typically includes removal of suspended and/or dissolved solids through filtration, removal of minerals through ion exchange, and removal of bacteria via chlorination, ozone or UV light. Very high-quality water is necessary for boiler feedwater to maintain the integrity of the boiler and steam systems.

The steam produced by the boiler(s) is used for many purposes. For instance, at plant start-up, steam is used to warm and prepare the equipment for use. Steam operates turbines and pumps that move materials through the plant piping and vessels. As well, steam is used as a feed into the process.

High-purity steam and/or water acts as a component in some of the chemical reactions required to formulate the product. Most often the water is delivered to the process reaction in the form of steam. For example, water is a necessary component of ethylene glycol manufacturing, which is produced from the reaction of ethylene oxide and water.

The cooling water system is another integral part of the process, in this manner as a utility. In order for hot process gas or water to be recycled for maximum efficiency, heat exchangers are used whereby cooling water absorbs excess heat from the other process stream. Most often, the heating/cooling cycle continues until the cooling water can no longer efficiently absorb more heat, and is pumped to an atmospheric cooling tower. Cooling towers consist of cells draining into a common sump, where circulation pumps move the warm water to the top of the cooling tower. The water trickles over internal baffles and ambient air is pulled over the falling water by large fans. Air movement creates evaporation, resulting in the cooling effect. The most efficient cooling towers recycle each molecule of water five to eight times before it is removed via blowdown.

Because of the warm water environment plus the loss of water to evaporation, cooling towers can easily become fouled with biological growth or solids. To manage cooling water quality and reduce fouling within the process heat exchangers, a cooling water treatment program and blowdown are both applied. Cooling water losses from evaporation and blowdown are made up with fresh water. Cooling tower blowdown is generally routed to effluent or wastewater treatment ponds.

Water is also often used at facilities for domestic and potable purposes, although these requirements are very small.

A final and critical use of water is for the maintenance of firewater systems on-site, readied in case of emergency. Firewater systems are typically fully-charged, non-consuming circulating piping systems – unless emergency response actions take place.

Some process units are equipped with air coolers in order to minimize water resource usage; however, there is a significant reduction in cooling efficiency using this method.

All of these activities produce wastewater that may need treatment prior to discharge into a receiving environment, which is either a natural river or a lake, or possibly to a purpose-built trickle or evaporation pond. Wastewater, storm water runoff and surface rainwater collected from developed areas, are most commonly collected in ponds and treated to remove hydrocarbons, contaminants and suspended solids (sludge).

Some facilities collect and reuse storm water from their site-developed areas to augment their intake water and wastewater, and reduce overall draw from the other source(s).

2.2 Linkages with Other Water Systems and Operating Parameters

ERCO Worldwide – *Grande Prairie*
ERCO Worldwide accesses water from the Wapiti River through a joint partnership with Weyerhaeuser. Through this relationship, Weyerhaeuser provides the ERCO plant with both mill water and potable water. The blowdown from the cooling towers is returned to Weyerhaeuser for final treatment and subsequent release back to the Wapiti River.

Dow Chemical Canada ULC – *Fort Saskatchewan*
Dow utilizes its water intake to provide water service for itself and other industries on or in proximity to the Fort Saskatchewan complex, including MEGlobal. Each company has its own water allocation under the Water Act, and their approvals note the water access "…through the works of Dow Chemical Canada Inc.". This service arrangement allows other users to access water from the North Saskatchewan River according to their approved water allocation, while simultaneously reducing the number of water intake structures in the river.

MEGlobal Canada Inc. – *Prentiss*
MEGlobal provides water service to Dow on the Prentiss site. This service arrangement allows Dow to access water from the Red Deer River through MEGlobal.

2.3 Review of Current Policies and Programs

2.3.1 Related Policies, Programs and Plans

A number of water-related provincial policies, programs and plans have the potential to directly affect the chemical industry. CIAC, in tandem with its member companies, engages with stakeholders through dialogue and consultation related to these known processes, eventually leading to the development of provincial and federal policies.

In conjunction with the Canadian Fuels Association (CFA), the chemistry industry has been a board member or alternate at the Alberta Water Council since the council's inception. CIAC has supported the objectives of the *Water for Life* initiative.

Locally-speaking, there are a range of organizations and management plans focused upon geographically-specific water issues supported and monitored by CIAC in locations where member facilities exist, such as:

– South Saskatchewan River Basin Water Management Plan (2015)
– Water Management Framework for the Industrial Heartland and Capital Region
– Watershed Planning & Advisory Councils (WPACs)
– Watershed Alliances

2.3.2 Related Legislated Conditions or Clauses

All aspects of chemistry facility operations, including water quantity, water quality, air quality, and soil and groundwater impact, have been regulated extensively since the 1960s under the Environmental Health legislation, and later the 1971 Alberta Clean Air and Clean Water legislation. As provincial and federal legislation and regulations evolve, the industry is internally-activated to anticipate and adapt to these changing conditions. Under Responsible Care, member companies not only commit to meet all regulatory requirements, but also work on continual improvement in reducing the impact on the environment, as demonstrated by the *Reducing Emissions* report, available on *canadianchemistry.ca*.

In Alberta, each CIAC member facility operates with an approval issued under the Alberta Environmental Protection and Enhancement Act (EPEA) and/or the Alberta Water Act. The approvals stipulate operating parameters as well as monitoring and reporting requirements. CIAC member companies are committed to not only comply but also consider deeply the environmental impact of their operations, through the ethic of sustainability.

Key water-related provincial legislation applied to the chemical industry includes, but is not limited to, the following governance:

– Alberta Environmental Protection & Enhancement Act
– Water Act
– Activities Designation Regulation
– Approvals & Registrations Procedure Regulation
– Release Reporting Regulation
– Substance Release Regulation
– Waste Control Regulation
– Wastewater & Storm Drainage Regulation
– Water (Ministerial) Regulation

Additionally, federal legislation, such as the Canadian Environment Protection Act and the Statistics Canada Industrial Water Survey, applies to the chemical industry.

Guidelines also provide clarity with regard to specific parameters or operations, and become legally enforceable when linked to an industrial approval. Some of the relevant water-related guidelines include, but are not limited to, the following governance:

– Environmental Quality Guidelines for Alberta Surface Waters
– Guide to Content of Industrial Approval Applications
– Water and Sediment Quality Guidelines
– Water and Wastewater Operators Certification Guidelines

2.4 Sector History of CEP

As with energy conservation, water use efficiency is an integral component of plant operations and continuous improvement under Responsible Care. Significant efficiency goals have been achieved through major capital expenditures, such as the construction of a new ethylene cracker or process train. Generally, newer technology ensures both greater efficiency and incremental associated environmental benefits. Due to the high capital costs of major process capacity new builds or modifications, these step-changes only occur approximately every five to ten years. Smaller efficiency initiatives are incorporated and expected on an ongoing basis, through regular maintenance and process control improvements.

Although the focus of CIAC's *Reducing Emissions* reports has been targeted at toxic substances and atmospheric emissions, the emission of metals-to-water has been recognized in the monitoring and reporting completed by CIAC member companies the *Reducing Emissions* report as early as 1992. The most current report may be found at: *canadianchemistry.ca/responsible_care/index.php/en/rc-report-2015-home*.

2.4.1 Examples of CEP Actions 2011-14

All facilities look for opportunities to conserve resources, and this journey never ends. For the most part, CEP improvements occur in small increments, stemming from persistent, ongoing efforts to improve performance.

As seen from the examples that follow, conservation-in-action can come from smaller facilities as well as larger ones:

- **Dow Chemical Canada ULC countered contamination with phytoremediation**
  (June-July 2012)
  Two pilot tree plantation areas were constructed on sections of the process block, which was the location of a former 1,2-dichloroethane (EDC) and vinyl chloride monomer (VCM) manufacturing plant. A total of 217 trees were planted. The main objective of the pilot tree plantations was to enhance passive hydraulic control via evapotranspiration of groundwater, thus reducing the potential for contaminant migration. The combination of the naturally-low permeability of the soils, the documented occurrence of natural attenuation of EDC, and the reduced hydraulic

gradients achieved by the phytoremediation tree plantation, has since eliminated the need for mechanically pumping groundwater through a granular-activated carbon (GAC) water treatment system. This project has demonstrated that phytoremediation can be a sustainable and effective alternative for the clean-up and containment of contaminated groundwater.

- **National Silicates implemented a heat recovery project**
  (May 2015)
  The project included the installation of piping to circulate the batch water through spray nozzles that direct the water into the steam plume inside the batch water tank when we blow the dissolver. This eliminates the need to preheat our batch water with steam. As a result, the numbers indicate that steam use has been reduced by 10-15%.

2.4.2 Other Initiatives

CIAC strongly supports the three goals of the *Water for Life* strategy: safe, secure drinking water supply, healthy aquatic ecosystems, and reliable, quality water supplies for a sustainable economy. This support is demonstrated by member company interaction and involvement within the communities in which members operate and their employees live. Safe and secure drinking water is not only a priority on the plant site, but also in the surrounding communities.

These companies have demonstrated their commitment to maintaining healthy aquatic ecosystems through their ongoing and long-term support of local projects, such as:

- **MEGlobal *and the* Ellis Bird Farm Ltd.**
  Located near the Prentiss petrochemical facility in the County of Lacombe, the farm operates and maintains a bird conservation program specifically to encourage the nesting and propagation of Mountain Bluebirds and Tree Swallows. The farm is now a charitable organization, with MEGlobal secured as the major funding partner.

- **Dow Chemical Canada ULC *and its* Wildlife Greenbelt Project**
  This environmental stewardship project, on Dow's Fort Saskatchewan site, was initiated in 1992 to limit the impact of the new Dow Hydrocarbon Product plant upon existing wildlife and to encourage the movement of wildlife throughout this area. The greenbelt contains ponds, a wetlands area, wildlife travel corridors, an observation deck, and an air-monitoring trailer where visitors can discover how the air they breathe is being monitored for quality.

3.0 Water Supply Considerations

Sustainable, quality, reliable water supply is important not only as a *Water for Life* initiative in the chemistry sector, but also to all sectors using significant quantities of H_2O. All of the sectors that developed CEP plans have already demonstrated their support for *Water for Life* goals. They continue to actively participate in regional and sub-regional water management framework discussions to address current and future water use management, both quantitatively and qualitatively.

While each sector has a relatively good understanding of their own water usage in today's context, factors such as population growth and climatic conditions are unquestionably hard to predict. Therefore, adaptation is often regrettably reactive instead of preferably proactive. Additionally, in areas of high population and well-developed economic activity, much of the surface water resources are already allocated –although not necessarily used.

One of the most difficult aspects of securing water supply over time is the frequent and frustrating reality that the most abundant sources of water exist in locations where the population is small or sparse, and industrial development projects are few and far between.

Evidently, ongoing conversations need to occur regarding water distribution and availability, in the interests of both the province and the local watersheds.

3.1 Water Demand Considerations

As discussed earlier, chemistry sector water consumption from existing facilities is relatively stable, with ongoing and small incremental reductions progressing/accumulating/proceeding as efficiency and consumption tactics are applied.

The opportunities for growth in the chemistry industry sector, and the decisions to leverage them, are related to many factors. When an organization contemplates a capital investment for building capacity, significant variables to be factored into the decision-making process include:

- Availability of reliable feedstock and other resources (at a long-term attractive price)
- Geopolitical stability and legislative certainty
- Cost of construction and available labour force
- Available government incentives (taxes, grants, partnerships, forgivable loans, etc.)
- Market timing (investment climate must be favourable)

If investments in increased production capacity are indeed made, the ensuing new facilities could seize the opportunity to innovate by incorporating technology to enable more efficient production. It must be noted, however, that increased capacity will inevitably lead to increased water demand, even with more efficient production units.

Consequently, it is important that increased production demonstrates both lower intensity and increased productivity for the water used. By this reasoning, developing a metric for intensity-based water use within the chemistry sector is certainly highly desirable, albeit undeniably complex due to the diversity of the products.

While the future of increased production and water demand is largely challenging to estimate, the companies with significant capital investments already made in Alberta at this time will likely remain for the long-term.

4.0 Overview of Opportunities for CEP

A key part of the CIAC member companies' Responsible Care commitment, and the CIAC endorsement of sustainability, is the expectation of facility operations to identify and fulfill opportunities to reduce consumption of all resources, including water and energy. These opportunities are reflected in enhanced conservation, efficiency and productivity; for example, reducing the amount of water used in a process means reduced intake and treatment of raw water. From that aspect alone, efforts to enhance the efficiency of water use makes sense not only from an environmental perspective, but also from the cost-effectiveness paradigm.

Another example is the debottleneck projects that resolve process-limiting equipment designs and increase production capacity, usually at smaller incremental water use or processing costs. Implementing these kinds of CEP opportunities will generally have a positive impact on all aspects of a facility's sustainability.

CEP opportunities identified for the chemical industry are focused upon process control and quality maintenance. As part of Responsible Care's expectation of continuous improvement, small incremental measures are implemented to both reduce waste from the process and enhance water use efficiency. Major step-changes in water use efficiency can be seen only when major capital investments are made, and/or a less-efficient process train is shut down.

The larger chemical-producing facilities are part of integrated and complex sites, not dissimilar from refining operations; therefore, the CIAC CEP opportunities naturally mirror many of the CFA-identified CEP opportunities.

4.1 Identification of All CEP Opportunities

In the initial chemistry sector CEP plan, many "options for improvement" were identified whereby an existing facility could potentially improve its overall water use. In addition, other organizations were working on the very same issue. For example, the *Industrial Heartland/ Capital Region Water Management Framework (2007-12)* report, which may be found at environment.gov.ab.ca/info/library/7864.pdf, includes options and goals that are echoed by the chemistry sector plan.

The most promising options for action identified by the chemistry sector included:

<u>Conservation (C)</u>

i. By-product/wastewater synergies, whereby one company uses/re-uses a stream from another facility

*i.e., **NOVA Chemicals** operates the wastewater treatment facility at Joffre, which both NOVA and INEOS use*

ii. Cooling water cycles can be optimized to minimize fresh water make up
(most chemical facilities have already implemented this)

iii. Consolidate wastewater streams for treatment at offsite facilities and re-use the treated wastewater

*i.e., the Phosphate Removal System at **NOVA Chemicals and Secondary Wastewater Treatment** facility, for the multi-facility complex*

iv. Segregation of storm water for reuse as cooling tower makeup

i.e., separate storm water and effluent ponds are used to segregate these streams at Joffre

v. Treatment, re-use and recycling of wastewater streams as fresh water make up
(this option has been investigated at some sites and found to be not feasible, based upon the changes required to apply it)

<u>Efficiency (E)</u>

vi. Recycle storm water as cooling water
(if a system is in place to capture and use storm water)

vii. Recycle of boiler blow down
(boiler condensate and blow down can be treated and recycled)

viii. Optimize boiler feed water treatment to minimize resultant wastewater

i.e., select demineralization media that require reduced water use, which minimizes the wastewater from boiler feed water treatment

<u>Productivity (P)</u>

ix. De-bottleneck the facilities to significantly increase the volume/weight of product, without a significant increase in water use

4.2 Analysis of CEP Opportunities

Some of the CEP opportunities identified in the original plan are already in place and may be further optimized in some facilities, while some are yet to be implemented. In the Industrial Heartland/Capital Region, the concentration of facilities within reasonable proximity of each other provides greater potential for innovative solutions, as discussed within the *Water Management Framework*.

Some of the CEP options have proved to be either technically impossible or prohibitively expensive to implement, since significant common infrastructure investments would ultimately be involved. Through the ongoing review of CEP plans, future opportunities will be identified, added and evaluated.

4.3 Selected/Recommended CEP Opportunities and Targets

The identified CEP opportunities will not necessarily be implemented universally within the sector, as some investments will be technically possible at one location and not at others. This scenario does mean, however, that each facility needs to evaluate its own opportunities and take advantage of what is thought will work.

The sector itself will continue to investigate opportunities for the industry, and share new ideas and innovations for sustainability, for all to benefit from the learning of others.

Collectively, the chemistry industry in Alberta and throughout Canada is expected to apply and to demonstrate their commitment to sustainability through reduced emissions, resource conservation, improved efficiency and increased productivity.

5.0 CEP Plan Implementation and Monitoring

5.1 Implementation Schedule

In 2012, as part of its commitment to Responsible Care, CIAC implemented the reporting of annual water use by member companies on a national basis.

Table 2, below, shows the type of data being collected. From this national data, CIAC will be able to track annual water intake and consumption by company, by site, by province and overall for the chemical industry (specifically, CIAC member companies).

TABLE 2
Example – CIAC Water Use Data Survey

YEAR	COMPANY	FACILITY	CITY	Facility Output Current Year	Facility Collects Water Use Data - Y/N	Water Consumption (m3/yr)	Surface Source Amount (m3/yr)	Source - Surface (see map) (0-25)	Source - Municipal (m3/yr)	Source - Ground Water (m3/yr)	Facility Collects Stormwater - Y/N
2012	ACME	Site-1	Anytown A	30359	Y	20,324	0	S. Sask	20,324	0	N
2013	ACME	Site-1	Anytown A	32249	Y	20,054	0	S. Sask	20,054	0	Y
2014	ACME	Site-1	Anytown A	29791	Y	19,555	0	S. Sask	19,528	0	Y
2012	ACME	Site-2	Anytown B	28762	Y	47,372	47,372	N. Sask	0	0	N
2013	ACME	Site-2	Anytown B	33273	Y	44,500	44,500	N. Sask	0	0	Y
2014	ACME	Site-2	Anytown B	56290	Y	44,500	44,500	N. Sask	0	0	Y

Additionally, CIAC will be able to monitor and report on the progress made to reduce water usage. While data has already been collected for the 2012-14 period, technical issues are being addressed to ensure the data is both consistent and accurate. CIAC is ultimately expecting to use this data to develop an intensity-based metric for water consumption and reduction.

CIAC will annually review progress on the implementation of Alberta's CEP opportunities through its Alberta Environmental Quality Committee (AEQC), and will endeavour to report on its website or via a public document, any and every implementation of significant company CEP initiatives. As well, individual facility licenses or approvals for water use and operation, water withdrawals and discharge continue to be reported to Alberta Environment and Parks.

5.2 Integration with Other Plans

CIAC and its member companies will continue to participate in the development of the regional management frameworks in areas where industry facilities are located. The key related management frameworks of areas where there is significant chemistry sector activity include:

- ***Water Management Framework for the Industrial Heartland and Capital Region***
  This WMF focuses on the Devon-to-Pakan reach of the North Saskatchewan River, and includes the CIAC member company water intakes in the Fort Saskatchewan area. Both water quantity and quality are considered in this WMF, with emphasis not only upon current but also future cumulative impacts

on the North Saskatchewan River.

- ***<u>Water Management Framework for the Red Deer River Sub-Basin</u>***
  This is another region of specific interest to CIAC and its member companies, serving as the water intake for the Joffre and Prentiss area facilities. The WMF for this region has been worked on for a number of years, but is still not finished. However, CIAC and member companies continue to be engaged in its development.

5.3 Monitoring and Reporting

As part of the accountability and performance measurement for Responsible Care, CIAC requires annual reporting by all member companies on key emissions, resource usage and waste management parameters, above and beyond the federal National Pollution Release Inventory (NPRI) and the provincial approval reporting requirements. The data from these reports is compiled and published in the annual Reporting Emissions report, and is available on the CIAC website.

6.0 Participation and Accountability

Member companies of the CIAC, under Responsible Care, initiate and maintain liaison with the communities in which they operate, through Community Advisory Panels (CAPs). The *CIAC CEP Plan* is one of the many industry-related documents shared for review and comments by its stakeholders.

7.0 Summary and Recommendations

This report documents water use for the chemistry sector (represented by member companies of CIAC) in Alberta. The CIAC member companies, with the Responsible Care commitment, have been implementing measures to reduce the impact of their operations on the environment.

In order to demonstrate that environmental responsibility is being taken seriously, the CIAC annually publishes *Reducing Emissions*. For more than 20 years, this report has documented the collective efforts of the chemical industry and the results achieved on reduction of emissions. Although individual companies have been implementing measures to reduce water consumption, improve water effluent quality, and enhance efficiency while increasing productivity, formalizing these efforts and documenting them in the CEP plan will also lead to a better measure of performance achieved. This *CIAC CEP Plan* represents the water use for the chemistry sector in Alberta, and is submitted as part of the chemical and petrochemical sector under the AWC guidelines.

Similarly to the CFA downstream petroleum-refining sector, the chemistry industry is a relatively small water user compared to the other six sectors identified in the AWC guidelines. As it does with other large industrial facilities, Alberta Environment and Parks (AEP), through the Environmental Protection and Enhancement Act (EPEA) and the Water Act, regulate the sector operations through comprehensive approvals. Approvals effectively document emission and discharge limits, and specify maximum contaminant levels in the emission or discharge, in order to protect the receiving aquatic system and overall environmental quality. CIAC member companies under Responsible Care commit not only to meet those environmental protection limits, but also work to keep the actual emissions and discharges well below those limits.

CIAC membership in Alberta consists of a range of larger, integrated complexes such as in Joffre, Prentiss or Fort Saskatchewan, plus a number of mid-sized or smaller operations. For this report, only the larger facilities were considered, since they represent well over 90% of the water consumption of the industry. The smaller facilities depend primarily upon municipal water supplies and discharge their effluent to municipal facilities.

Overall, the chemical industry is a relatively small water user compared to the other sectors with a compiled CEP plan, but the existing, relatively large capital investments indicate the facilities are here for the long-term, and will be depending upon available water use for many years to come. Concurrently, the chemical industry fully recognizes the importance of preserving the sustainability of our natural resources.

A vibrant and growing industry provides the best opportunity for innovating interdependently and implementing leading-edge technology on-site, aiming at altogether better control and efficiency. The most significant improvements in water use for the chemistry sector, as discussed in this plan, will be made with major capital investments related to stock turnover or expansion. These scenarios will enable older, less efficient equipment to be taken out of service and replaced with current technology, resulting in greater efficiency and productivity.

At the same time and on an ongoing basis, smaller efforts will be the drivers of implementing CEP opportunities. It is difficult to set targets, but CIAC has demonstrated that the smaller, year-over-year efficiency improvements do add up to important improvements.

These improvements are what the chemistry sector will purposely work toward in the implementation of the *CIAC CEP Plan*.