

2017

Sustainability Report

Performance Update and Case Studies



Operations



Communities



Products



Environment

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All amounts in this report are in USD unless otherwise specified.



On the cover: Case studies featured inside illustrate key activities in the areas of Operations, Communities, Products and Environment.

Advisory

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Responsible Care® and Sustainability

When Responsible Care was developed in 1985, it was an expression of the chemistry industry's commitment to safety. Over the years it has evolved to include the industry's commitment to sustainability — the betterment of society, the environment and the economy.



Responsible Care®
Our commitment to sustainability.

A way to think and a way to work

Taking Care

Our work at NOVA Chemicals results in plastic products that take care of food, water and other goods vital to life. To enable these products, we must first take care of the people, places, materials and processes that make them possible. We take care with respect to our operations, communities, products and the environment. Taking Care is a way to think and a way to work. It's our particular approach for putting Responsible Care into practice.



Operations



Communities



Products



Environment

A Message from the NOVA Chemicals Management Board



Todd Karran



Julie Beck



John Thayer



Naushad Jamani



Arnel Santos

To grow and improve as an organization requires a mindset that is relentless about learning and collaborating. The past year was marked by progress on our ambitious growth strategy, all while maintaining our unwavering commitment to sustainability and Responsible Care. We know that growth cannot come at the expense of our values and commitments, and in fact, they are core to our success.

One of the important roles that we have as a leadership team is to steer our Responsible Care and sustainability strategy. As a founding member of Responsible Care, our expectations for ourselves are high, and we know that we can continually improve.

We use our annual sustainability report as a way to share our achievements, and as an accountability tool. In this year's report, we highlight four case studies. The case studies are only a few examples of many innovative and inspiring employee initiatives that make our company and our communities better. With our firm commitment to transparency and continual improvement, we share year-over-year economic, social and environmental performance data at the back of the report.

As we pursued our strategy in 2017 to meet the growing demand for polyethylene in the Americas, a major highlight was our acquisition of our interest in the Louisiana olefins plant and complex. Located in the largest refining and petrochemical production hub in North America, this acquisition is a major step for our company, allowing us to grow our presence in the U.S. Gulf Coast. In 2017, we announced plans for two large-scale capital investments in the Sarnia-Lambton region which include the expansion of our Corunna cracker by approximately 50 percent to provide feedstock to a new polyethylene facility. We recently completed converting our Corunna plant to use up to 100 percent ethane feedstock. In 2018, we entered into a joint venture with affiliates of Borealis AG and Total S.A. to share existing and build new facilities in Texas.

Innovation has been at the heart of NOVA Chemicals since our inception, and today more than ever, delivering game-changing technology is critical to our success. We take a customer-focused approach, identifying opportunities to create new products that perform better with less environmental impact. Our employees collaborated with customers to create a film structure that is a fully recyclable alternative to the current multi-material, non-recyclable film structures used in stand-up pouches. This film structure meets recycling requirements, while satisfying all food safety, cost and manufacturing criteria.

At NOVA Chemicals, we are passionate about science, and about sharing that passion with the next generation. Our genScience program is one way we are addressing declining enrolment in the fields of science, technology, engineering, arts and math in North America.

In every facet of our business, safety is, and will continue to be, our number one priority. Our goal is zero workplace injuries and illnesses. We applaud our employees for the many operational safety successes of 2017; however, we did not achieve zero injuries. We must all continue to take accountability for our own safety and the safety of others by focusing on operational discipline and safety leadership. Each of us has made clear that safety starts with our own commitments and we have communicated our personal safety pledges throughout the company.

We have a clear vision for growth, and our success depends on living our values and fulfilling our commitments. We want to express our deepest thanks to our employees for their efforts and for wholeheartedly embodying the company's values. Together, we are shaping a world where products vital to health and happiness are even better tomorrow than they are today.

– NOVA Chemicals Management Board

Key Company Changes

- Musabbeh Al Kaabi joined NOVA Chemicals' Board of Directors as Vice Chairman.
- We made progress on three key areas of our strategic growth plan to meet consumer demand for polyethylene:
 - In July 2017, we completed the acquisition of interest in the Geismar, Louisiana olefins plant and complex, an operating facility with positive cash flow and significant opportunities for future growth.
 - In December 2017, we announced two large-scale capital investments in the Sarnia-Lambton region involving the expansion of our Corunna plant by approximately 50 percent and building a new polyethylene facility.
 - In May 2018, we closed a joint venture with affiliates of Borealis and Total which includes an under-construction cracker in Port Arthur, Texas, Total's existing polyethylene facility in Bayport, Texas and a planned new Borstar® polyethylene unit at Bayport, Texas.
- In April 2018, John Thayer, previously Vice President, Polyethylene Marketing, assumed the role of Senior Vice President, Polyethylene Business; after Chris Bezaire, Senior Vice President, Polyethylene Business retired from his position.



We empower our employees to fulfill our mission: to be the leader in innovation that enables our customers to deliver plastic products that make everyday life healthier, easier and safer.



Our employees have diverse opportunities to help them grow in their roles and careers, and initiatives to support their desire to enjoy a better, balanced life.

About NOVA Chemicals

NOVA Chemicals develops and manufactures chemicals and plastic resins that make everyday life safer, healthier and easier. In all that we do, our employees work to ensure health, safety, security and environmental stewardship through our commitment to sustainability and Responsible Care. Our company is headquartered in Calgary, Alberta, Canada and has operations in Alberta and Ontario in Canada, and Pennsylvania, Ohio and Louisiana in the U.S. NOVA Chemicals is wholly-owned, ultimately by Mubadala Investment Company of the Emirate of Abu Dhabi, United Arab Emirates.

We help to shape a world where the products vital to human health and happiness are even better tomorrow than they are today. Our plastic resins are used in a wide range of consumer and industrial applications, including flexible packaging for dry, liquid and frozen foods as well as non-foods; protective packaging for electronics and other durable goods; and a wide range of rigid goods and containers such as bulk storage containers, playsets, and closures.

If you want to learn more about how NOVA Chemicals is helping shape a better world, watch [this video](#).

Our Growth Strategy

Our strategy leverages our ability to deliver game-changing technology and create an exceptional customer experience so that we can meet growing consumer demand for polyethylene in the Americas.

We have several key strategic priorities, including:

1. **Growing significantly** beyond our traditionally Canadian production footprint. This includes gaining additional access to U.S. Gulf Coast feedstock and supplying customers throughout the Americas.
2. **Delivering game-changing technology** that makes tomorrow even better than today.
3. **Being actively sought after** by all our stakeholders.

We believe our passion, innovation, collaboration and responsible behavior are key to helping our customers and delivering on our strategy.

We are helping to shape a world where the products vital to human health and happiness are even better tomorrow than they are today.



We produce resins that are used in food packaging, bottle closures, shrink wrap, protective packaging, heavy duty sacks, trash and liner bags, bulk storage and more.

2017 Corporate Highlights

January



Our new linear low-density polyethylene (LLDPE) gas phase reactor at Joffre, Alberta made its first shipment to customers. The added capacity allows us to meet the growing demand for flexible films used in food packaging, heavy-duty sacks and can liners.

February

We introduced dedicated workstreams to our 1NOVA Program, our internal effort to establish one set of best practices and systems across the organization to optimize how we work together.



April



We introduced a new wellness online platform as part of our Total Well-Being program to help employees take care of their physical, emotional, social, financial and environmental wellness.

June

We designed a recyclable oxygen barrier film structure, which can be used to package food products such as meat, cheese and nuts that traditionally have been in non-recyclable, mixed-material packaging. See Products case study on page 16.



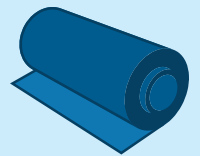
July



We completed the acquisition of interest in the Geismar, Louisiana olefins plant and complex. Located in the largest refining and petrochemical production hub in North America, this acquisition is a significant opportunity to grow our presence in the U.S. Gulf Coast.

August/September

We debuted three new high-performance sealant resins for multi-layer film structures. Using our proprietary Advanced SCLAIRTECH™ technology, these cutting-edge resins enable outstanding performance for demanding sealant applications.



October



With the aim of sparking passion and discovery for the sciences, technology, engineering, arts and math, we launched our genScience program. Read more in the case study on page 14.

December

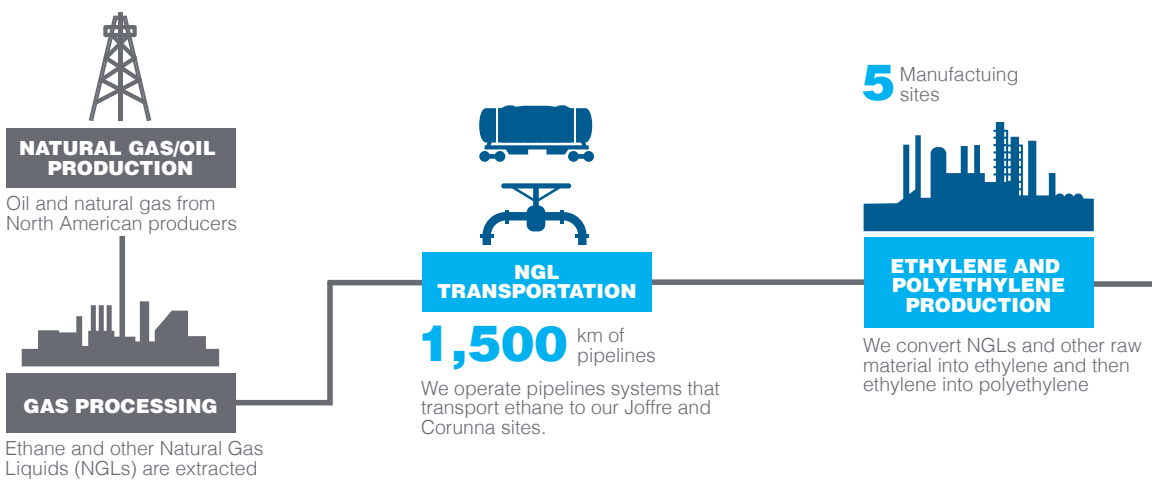
We launched NOVA's Nature, a new way to talk about and live our corporate values through daily practice and habits.



\$3.8 billion 2017 Revenue

2,900 Employees

**OLEFINS/
POLYETHYLENE**



3,000
Suppliers



3 Research centres

RESEARCH AND DEVELOPMENT

VALUE CHAIN MANAGEMENT

RESPONSIBLE CARE

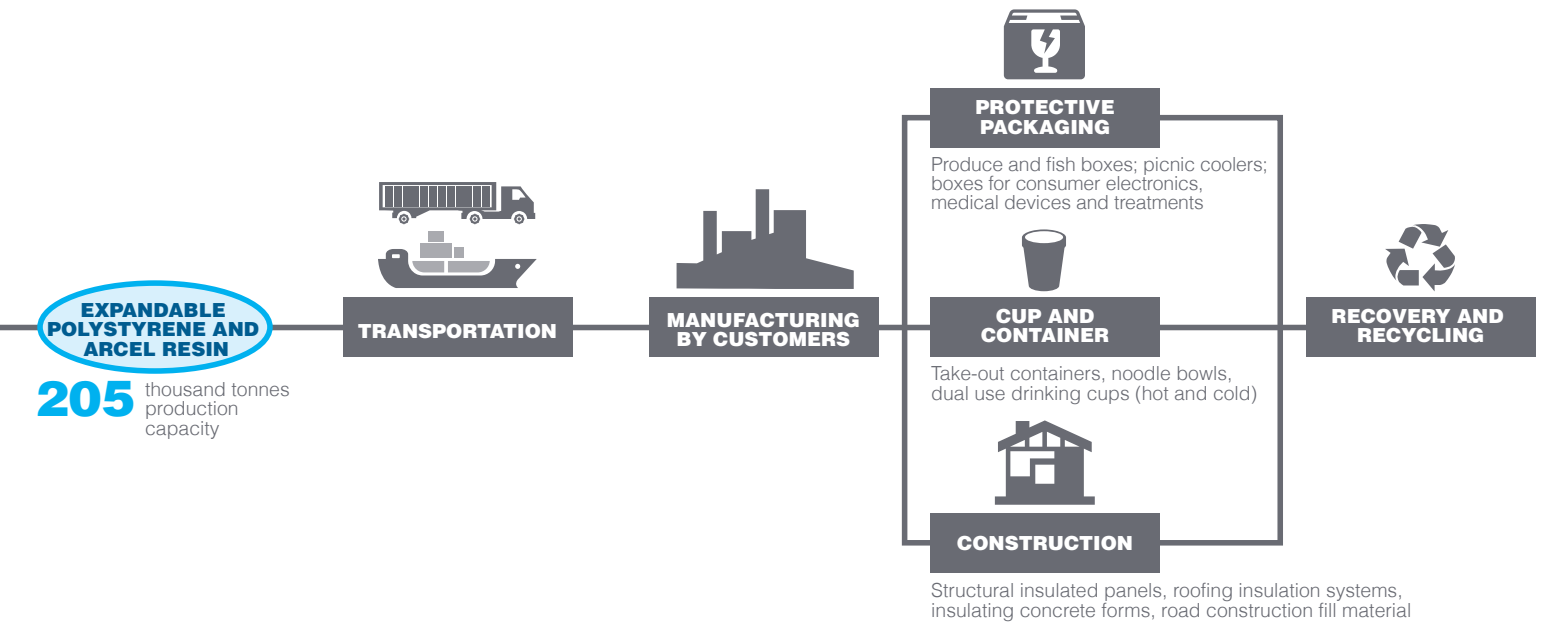
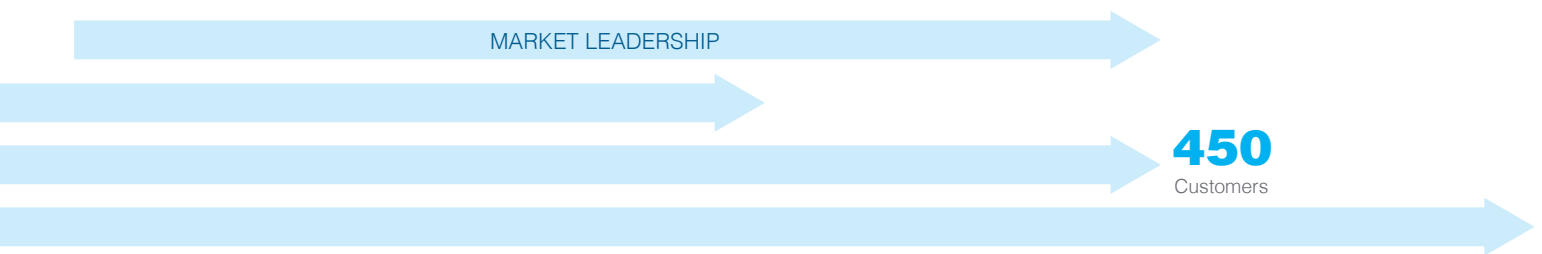
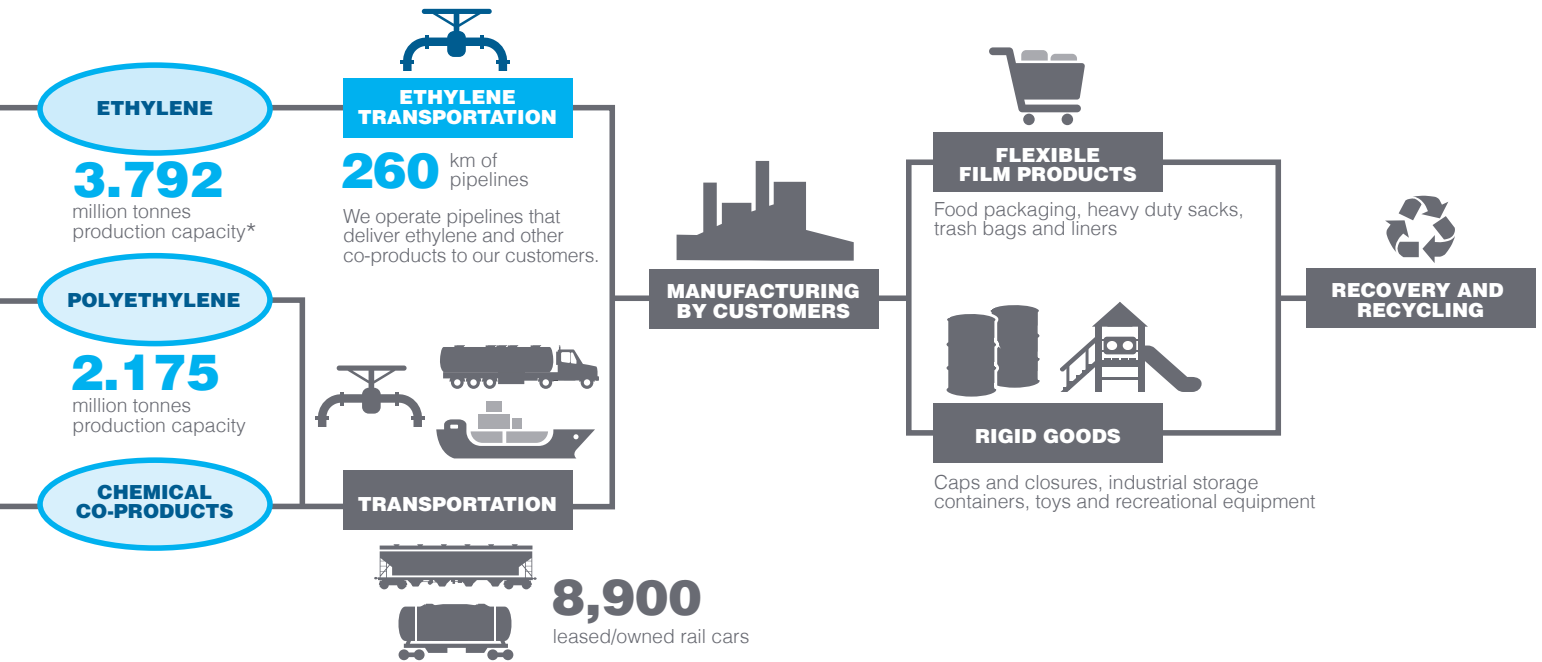
**EXPANDABLE
STYRENICS**



- Directly Controlled Assets
- Non-Controlled Areas

Statistics shown as of December 31, 2017

*Includes NOVA Chemicals' 50 percent share of joint venture facility (E3) and NOVA Chemicals' share of the production capacity of the Geismar cracker



About this Report

The purpose of this report is to demonstrate our commitment to sustainability and to transparency about the economic, social and environmental dimensions of our performance. We use case studies to illustrate key activities in the areas of Operations, Communities, Products, and Environment, followed by a data summary to share performance metrics most relevant to our stakeholders and to the success of our business.

The list below describes the scope of this report and some key reporting practices:

- Full performance data is provided in the Performance Summary on page 20. Unless otherwise noted, the performance data in this report covers 2017, with historical data dating back to 2012.
- Performance data reflects NOVA Chemicals and our subsidiaries covered in our consolidated financial statements.
- Data is typically not provided for assets/companies that we acquire until after the first full year of ownership to enable full integration of systems. As a result, safety and environmental for 2017 excludes performance from

the Geismar facility. However, employee and financial data is stated as of December 31, 2017 and it includes our Geismar business since the date of acquisition (July 6, 2017).

- We used the Global Reporting Initiative (GRI®) Standards to help determine report content and related indicators in this report. The report contains disclosures from these standards, but has not fulfilled all the requirements to be 'in accordance' with the GRI Standards.
- Unless otherwise noted, financial data is in U.S. dollars and environmental data is in metric units.
- Senior management and relevant staff have reviewed all information and believe it is an accurate representation of our performance. Third-party assurance of our sustainability report was not conducted.
- The terms NOVA Chemicals, our, we, the company and the corporation refer to NOVA Chemicals Corporation and its subsidiaries as a whole.

Our Values

Be Responsible — We conduct ourselves with honesty and integrity, and take accountability for our actions.

Be Passionate — We are motivated and energized to help shape a world that's even better tomorrow than it is today.

Innovate — We fuel our success with everyday curiosity, imagination and creativity.

Collaborate — We proactively reach across boundaries to partner with each other as well as our customers, suppliers and communities.



The Foundations of Sustainability

At NOVA Chemicals, we believe a sustainable business requires a foundation of ethical behaviour, strong governance and stakeholder engagement. Our growth strategy means we will likely work with an increasing number of colleagues and partners to explore new opportunities. Continuing to hold ourselves to the highest ethical behaviour is paramount.

Our Code of Conduct sets out expectations for integrity and ethics in our business dealings and is a critical part of our onboarding process and annual training. “We are all expected to comply with the laws and regulations of the countries in which we do business,” says Lou Krzemien, Chief Compliance Officer. “When legal requirements are unclear, we will always make decisions consistent with our values and the Code.”

Although anti-corruption is top of mind when many think of business ethics, there are several more facets to acting ethically. We have a responsibility to each other, to the market, and to the community to behave ethically.

Our Board of Directors and the NOVA Chemicals Management Board (NMB), which is composed of members of senior management, oversee and steer our Responsible Care and sustainability strategy. In addition to the Code of Conduct, our Responsible Care and Sustainability Policy outlines our commitments to communities, customers, employees and other members of society. To learn more about Governance at NOVA Chemicals, [click here](#).

Our continued success depends on understanding and respecting the needs and interests of stakeholders at every stage of our operations. We continue to engage and welcome input from all our stakeholders. To read more about specific initiatives in our Joffre, Alberta community, [click here](#) and in our Sarnia-Lambton community, [click here](#).

Acting Ethically, We Have a Responsibility...

To Each Other:



Value Diversity



Prevent Harassment



Promote a Safe and Healthy Workplace

To the Company:



Avoid Conflict of Interest



Business Courtesies (Gifts/Entertainment)



Information Security



Intellectual Property

In the Marketplace and Community:



Competition



Corruption



Protect the Environment (RC/Sustainability)



Good Ambassadorship



In our operations, we take care to attract and develop talented people committed to the safety and well-being of themselves and others. We foster relationships that promote community safety and other social and environmental values.

Operations Case Study

Safely Executing a Strategic Project

A development in one industry can often create a ripple effect throughout the value chain. Improved shale gas extraction methods in the U.S. revolutionized the North American energy industry and with it, industries like ours that use hydrocarbons as a primary feedstock. The opportunity to use this abundant, reliable and lighter resource to feed our eastern Canadian ethylene facility was seen as a strategic imperative for NOVA Chemicals. It would extend the life of one of our core assets and enable us to better compete on the world stage. Seizing the opportunity required us to be nimble.

The Safety Challenge

We desired to convert our Corunna facility to use up to 100 percent ethane feedstock, and modify the associated pipeline delivery systems accordingly. The challenge was to execute the ethane conversion project during scheduled facility downtime. The project required four local major contractors, and at the peak there were approximately 2,000 workers on-site.

“It was highly complex,” says Rob Thompson, Regional Operations Leader for Manufacturing East. “Picture construction workers on scaffolding, or fitting new piping, and on a different level a crew cleaning, all within a facility undergoing a shut down.” With that many activities and workers on site, safety had to be top of mind.



Collaboration and Communication

Given the project complexities, ongoing safety was paramount for the project team. From beginning to end, everyone was committed to safety, and developed an exceptional safety culture. Given that there were two major ongoing projects, the project management, operations and maintenance teams all had to work in a highly integrated fashion. A steering team with representatives from all involved groups was key; ensuring that all issues were considered and all teams had a voice at the table. This 'one team' approach trickled down to all project team members, who remained engaged and positive.

We also needed to integrate systems and procedures. Responsible Care was aligned between the two project teams so that contractor and worker management plans, training orientation, safety systems and reporting and recognition programs were unified.

Another challenge was the labour required to execute a project of this scale. We had to balance the needs of running and maintaining our facility, and avoiding overtaxing the capabilities of local construction companies while meeting our deadlines. The project required the involvement of a significant number of local contract workers.

Strong project planning and design was important, but most important was a commitment to collaboration and communication. "We had to make sure everyone on the project was on the same page every step of the way," says Scott Randall, Project Manager, All Ethane. "During project execution we had constant communication back and forth between teams to make sure everyone was aware and safe. The teams had daily safety huddles and worked together to solve any issues that arose."



Success

In January 2018, U.S. shale gas was delivered through our new pipeline and the facility was officially capable of all-ethane feedstock. We achieved this milestone safely, below budget and on schedule. Perhaps most impressive is that through 900,000 field hours worked over one and a half years, NOVA Chemicals and our contractor teams achieved a Total Recordable Case Rate of 0.45¹, well below the Ontario construction industry average².

Through this challenging project we demonstrated that we have the dexterity to overcome great complexity, meet tight timelines and, most importantly, uphold our commitment to Responsible Care and the safety of our people.

¹Injuries per 200,000 work hours

²Lost Time Injury Rate of 1.09 for construction industry average for 2015

Illustrating NOVA's Nature: **Collaborate**

- We proactively reach across boundaries to partner with each other as well as our customers, suppliers and communities.
- We collaborate by aligning on common goals, encouraging every voice and building networks that matter.



In our communities, we take care to be a neighbor that promotes conversation, understanding and involvement. We contribute positively to community development, public policy and reporting.

Communities Case Study

Sparking Passion in the Next Generation

While we expect many of the jobs of the future to be in science, technology, engineering and math (STEM), some young people are shying away from careers in these fields. This so-called STEM gap is not a new problem, but is increasingly relevant for our industry and our company. A report from the U.S. Bureau of Labor Statistics anticipates the number of STEM jobs to grow 13 percent³ between 2012 and 2022. This represents a challenge that NOVA Chemicals is eager to tackle. Fewer students pursuing STEM careers has significant societal implications, and also affects our ability to fill positions like scientists, engineers, technicians and accountants that we need to continue to shape products that make everyday life healthier, easier and safer.

"We saw the need to attract and encourage young people to explore the sciences, and at the same time, our employees were telling us they wanted ways to get involved in the community," says Pace Markowitz, Director of Ventures and genScience program sponsor. "We created the genScience program as a way to help our employees share their knowledge and passion, which we hope will inspire kids in our community to explore STEM education and careers."

A Hands-On Approach to Science

One way that genScience sparks passion and discovery in students is by using hands-on activity kits that NOVA Chemicals volunteers can use at community science fairs and events. From making slime to testing chemical reactions, genScience activities are an exciting way for kids to learn about scientific processes and reactions. The genScience team is also working to infuse arts into activities as a way of helping students tap into their creativity. Our enthusiastic volunteers help kids connect science and arts to the real world, empower them to try something new and show them that making mistakes is part of progress.

"Some kids are apprehensive when they approach our booth," shares Rachel Shento, Communications Consultant, Engagement and genScience program leader. "But after the first experiment you see a flicker of interest and they start asking questions. Getting even one kid excited about science makes it all worthwhile."



Sparking passion and discovery in students

³ <https://www.bls.gov/careeroutlook/2014/spring/art01.pdf>



Driven by Dedication

It's our employees that make genScience possible. More than 30 employees from across the company dedicate their time and energy to genScience, reaching approximately 2,000 students at community and on-site events in 2017. There is a whole team behind the program, with volunteer workstreams dedicated to activity development, process development, communications, and employee engagement and training. An advisory committee guides the overall program, helping to make sure all components are aligned and moving forward.

"Our employees' enthusiasm is contagious," says Rachel. "They volunteer because they love their jobs and they want to spark that same passion in kids."

"I have seen how easily kids can give up on math and science when it seems hard," says volunteer Amy Breathat, NOVA Chemicals Safety Engineer and genScience team member since its early development. "I hope that we can create interest in these subjects by showing how they are part of many things that kids interact with every day."

Looking at the Future

In 2018, the genScience team hopes to bring on more employee volunteers, as well as launch a new external webpage so that the public can access resources and activity sheets. The team also plans to expand current programming to include activities that incorporate the arts, and that spark discussions about plastics in our world. At NOVA Chemicals, we want to have meaningful conversations about the role of plastics in our lives — from the beginning to the end of plastics' life.

genScience is only part of NOVA Chemicals' involvement in encouraging innovation. We also partner with science centres, hold mentorship days and attend community career cafés that focus on STEM. "We're exploring how we can take the excitement of genScience and expand it beyond our events," says Rachel. "We want to create opportunities so kids can keep learning, experimenting and exploring the world."

Illustrating NOVA's Nature: **Be Passionate**

- We are motivated and energized to help shape a world that's even better tomorrow than it is today.
- Being passionate means we rally others around us, fully engage in our work and drive change within our organizations.



We innovate to improve people's lives. Our products and the applications they enable promote safety, integrity and value throughout their lifecycle.

Products Case Study

Enabling Products to be Even Better Tomorrow Than They Are Today

Society is changing and so is NOVA Chemicals. People are becoming increasingly concerned about the depletion of natural resources and managing global waste. The traditional “make-use-dispose” system is no longer serving humankind and the circular economy is gaining traction. In a circular economy, products are designed to minimize resource use and enhance reuse and recyclability. Applying this perspective to NOVA Chemicals’ product development is a critical piece of our commitment to Responsible Care and sustainability. With this in mind, we saw an opportunity to develop new and improved film structures for use in stand-up pouches.

The Complexities of Design

Flexible packaging, like the stand-up pouch, offer significant environmental impact reductions over traditional packaging formats. For example, a baby food glass jar weighs approximately 70 grams while a flexible pouch with the same volume weighs just 7 grams. That reduction in material use alone is considerable, but the energy and emission reductions related to transportation are equally impressive. Transporting the same number of empty containers requires 23 trucks for the glass jars versus just one truck for the empty pouches⁴.

However, most stand-up pouches on the market today have a multi-material construction that makes them non-recyclable. Rob Clare, Application Development Specialist at NOVA Chemicals, knew there had to be a better way. “Part of being a leader in our industry means looking for new and innovative ways to address society’s demands.”

Rob and the team set out to design a pouch film structure that would meet recyclability standards, along with a wide range of other requirements:

- Moisture and oxygen barrier, stiffness and durability for shelf life and product integrity;



- Crisp package graphics, clear product windows, and smooth glossy or matte finish for shelf appeal;
- Easy-open and reclose ergonomics to deliver a better at-home consumer experience; and
- The ability to produce the film and packaging on conventional equipment and at a comparable manufacturing cost to traditional film structures to drive industry adoption.

⁴Flexible Packaging Association. (n.d.). FPA member case stories. Retrieved from https://www.flexpack.org/assets/1/6/FPA_Lightweighting_Case_Stories.pdf



Effytec horizontal form fill seal (HFFS) pouch maker at our Centre for Performance Applications

Stand-Up Pouch, Version 2.0

Achieving all of this with a recyclable film structure seemed a lofty challenge, but we succeeded by combining best-in-class polyethylene products, deep knowledge of film structure design and end user packaging equipment, and a collaborative approach. Our fully-recyclable alternative to the typical stand-up pouch film structure is compatible with the traditional HDPE #2 recycling stream and is approved for the How2Recycle® store drop-off program label, while satisfying all performance, cost and manufacturing criteria.

The new film structure design has attracted the attention of major brands and packaging manufacturers. A national meal kit delivery company has commercialized a recyclable package for one of its ingredients based on our design, and over half a dozen brand owners have it in trials. "Our focus for the coming year is to collaborate with our customers and help them qualify recyclable film structure designs for the specific requirements of their applications," says Rob.

A Culture of Innovation

Rob and his colleague Alexei Kazakov, Market Development Manager, recently received an Industry Leadership award from the [Canadian Plastics Industry Association](#) for this innovation and their commitment to sustainability.

"I really credit the culture of innovation here at NOVA Chemicals," says Rob. "We're given the freedom, resources and equipment to explore new concepts. What started as an idea is now a commercially viable, long-term solution that can help keep stand-up pouches out of landfills. We're moving one step closer to the goal of a circular economy."

*Illustrating NOVA's Nature: **Innovate***

- We fuel our success with everyday curiosity, imagination and creativity.
- We innovate by learning and growing every day, challenging our biases and finding a better way to do our work.



In our environment, we take care to conserve, protect and enhance natural resources. Through innovation, operational excellence and environmental stewardship, we seek to protect life and to continuously improve our environmental performance.

Environment Case Study

Approaching Sustainability Holistically

Sustainability compels us to think about our business and our assets as a whole, more than the sum of its parts. Just as NOVA Chemicals assesses our products throughout their lifecycles, we do the same for our operations. From the planning stages to the retirement of an asset, we consider Responsible Care and the environmental impacts of our operations and facilities. In 2017, our environment team engaged in different projects such as harvesting native plants, extending the life of our current facilities and ensuring the safe and responsible demolition of a power plant at its end of life.

Co-Existence of Industry and Nature

Responsible Care applies to our everyday operations as well as our future growth. Part of our expansion strategy in Ontario includes considering how we can mitigate the impact of our operations on the environment.

In July of 2017, NOVA Chemicals collaborated with members of the Aamjiwnaang First Nation and the non-profit organization [Return the Landscape](#) to harvest native plants from the land planned for facility use just south of our existing Corunna plant, in Ontario. Vegetation native to the Sarnia-Lambton area can have unique relationships with local species, qualities that cannot always be

replaced by non-native species. "Part of our commitment to Responsible Care is protecting biodiversity near our operations," said Michael McLachlan, Environmental Engineer, NOVA Chemicals. "We supported the collection of the native plants so that seedbanks can be preserved and the collected plants can be reincorporated into the local ecosystem." More than 1,000 native plants were collected over three days and then transported to the greenhouse at Aamjiwnaang First Nation where they were sold to the community for landscaping and restoration.



Members of Aamjiwnaang First Nation harvesting native plants with landscaping personnel from Return the Landscape and Williams Landscaping

Extending the Life of Assets

As facilities age and technology changes, plant modernization plays a critical role in our approach to sustainability. Although upgrades frequently are driven by operational and maintenance needs, they can also generate significant environmental benefits. The recent furnace refurbishment project at our Joffre, Alberta site extended the life of the furnaces, increased efficiency and reduced nitrous oxide emissions.

The refurbishment project helped us meet our production needs to support the recent major plant expansion and allowed the facility to operate at full design capacity. During refurbishment, we incorporated other improvements, such as enhanced safety systems, and achieved air emission reductions.

Replacing five of the 11 furnaces' convection and burner systems using next-generation burner technology resulted in nitrogen oxide (NO_x) emissions reductions. With the project two-thirds complete, emissions tests show that the improvements led to a 30 percent reduction in NO_x emissions from each furnace stack. Also, improvements in the energy efficiency of the furnaces result in additional greenhouse gas emission reductions.

In late 2017, NOVA Chemicals approved phase two of this project, which will focus on refurbishing four of the remaining six furnaces starting in 2018.



Responsible End of Life

As part of our acquisition of the Beaver Valley Site in 1996, NOVA Chemicals inherited the lease for an independently operated, onsite coal-fired generation plant. When the operator shut down the power plant in 2015, we began to fulfill our duty to demolish the plant and remediate the site.

This project included the closure of the coal-fired plant which leads to the reduction of regional air emissions and the elimination of the coal dust and fly ash. A parallel project was initiated to install a new substation and power distribution system to allow for the demolition of the main power house where this equipment is currently located. Relocating these utilities is expected to result in water use reductions as well as improved efficiency, safety, and reliability.

Built in 1942 as part of the United States' World War II Synthetic Rubber Program, the coal-fired plant was a substantial structure. It was, at the time, the largest continuous pour of concrete in the world. The seven-story main powerhouse covers approximately 40,000 square feet and was designed to withstand a direct hit from a 500-pound bomb. This challenging demolition project includes:

- Completing a hazardous materials assessment and remediation involving large quantities of asbestos insulation, lead caulking, mercury in meters, and PCBs (polychlorinated biphenyls) in electrical equipment;
- Demolishing the external buildings and coal handling systems that share pipe racks and utilities with an operating facility; and
- Salvaging equipment and materials for resale, reuse or recycling.

One-third of the way through the project, we have removed:

- 80 metric tonnes of asbestos-containing materials;
- 4,300 metric tonnes of steel; and
- 3,600 metric tonnes of construction debris and concrete.

All of the metal was sent for recycling and we diverted 25 percent of the concrete waste from landfill by using it onsite.

"Being a responsible company means setting aside the appropriate resources needed to meet our end-of-life environmental obligations", explains Jim Dixon, Director Responsible Care. "The ultimate goal of the Beaver Valley power plant demolition and remediation project was to convert the site to an area available for redevelopment, and of course, do so in a responsible and safe manner."

Illustrating NOVA's Nature: **Be Responsible**

- We conduct ourselves with honesty and integrity and take accountability for our actions.
- Being responsible means we think holistically, keep our promises and show a zest for zero.

Performance Summary

	Units	2013	2014	2015	2016	2017
Foundations of Sustainability						
Business Ethics						
Matters Received	count	n/a	70	74	80	95
Questions	count	n/a	n/a	52	56	66
Code Violation Allegations	count	n/a	n/a	22	24	29
Unsubstantiated	count	n/a	n/a	12	10	19
Substantiated	count	n/a	n/a	6	8	10
Remained Open at Year End	count	n/a	n/a	4	6	0
By category						
Accounting, Auditing and Financial Reporting	count	n/a	n/a	n/a	2	1
Business Integrity	count	n/a	n/a	n/a	63	80
HR, Diversity and Workplace Respect	count	n/a	n/a	n/a	12	11
Environment, Health and Safety	count	n/a	n/a	n/a	3	3
Misuse, Misappropriation of Corporate Asset	count	n/a	n/a	n/a	0	0
Operations						
Employee and Contractor Safety						
Recordable Injury Rate — Employees	count per 200,000 exposure hours	0.66	0.32	0.32	0.35	0.45
Recordable Injury Rate — Contractors	count per 200,000 exposure hours	1.37	0.65	1.00	0.57	0.77
Combined Recordable Injury Rate	count per 200,000 exposure hours	0.96	0.46	0.65	0.52	0.61
Lost-Time Injury Rate — Employees	count per 200,000 exposure hours	0.15	0.07	0.14	0.17	0.10
Lost-Time Injury Rate — Contractors	count per 200,000 exposure hours	0.21	0.10	0.04	0.04	0.07
Combined Lost-Time Injury Rate	count per 200,000 exposure hours	0.17	0.08	0.09	0.11	0.09
Fatalities — Employees and Contractors	count	0	0	0	1	0
Vehicle Incidents	count	100	102	149	76	122
Near Misses	count	1,861	693	572	502	563
Hazardous Conditions Reporting	count	10,882	3,009	1,032	1,164	2,240
Process Safety						
Total Process Fires	count	24	14	13	13	17
Transportation Safety						
Non-Accident Releases ¹	count	2	0	0	0	0
Recordable Distribution Incidents ²	count	1	3	1	1	3
All Reported Material Distribution Inquiries ³	count	15	10	16	12	10
Employees						
Total Number of Employees	count	2,472	2,565	2,663	2,724	2,857
Full-Time	count	2,402	2,497	2,587	2,657	2,782
Part-Time	count	70	68	76	67	75
Female	count	619	633	669	700	707
Male	count	1,853	1,932	1,994	2,024	2,150
Employees in the U.S.	count	440	438	427	434	559
Employees in Canada	count	2,032	2,127	2,236	2,290	2,283
Employees Covered by Collective Bargaining Agreements	percent	12.0	11.7	12.1	12.0	12.0
Total New Hires	count	208	187	193	184	168
Rate of New Hires	percent	8.4	7.3	7.3	6.8	5.9
Voluntary Turnover Rate	percent	3.2	3.1	4.5	3.3	4.9

	Units	2013	2014	2015	2016	2017
Communities						
Community Investment and Volunteering						
Community Investment	\$ millions	n/a	1.9	2.0	2.3	2.4
Volunteerism	hours	n/a	4,800	5,200	6,797	5,836
Economic Value Generated and Distributed						
Revenues	\$ millions	5,278	5,159	3,580	3,512	3,844
Taxes Paid	\$ millions	168	241	261	94	68
Salaries and Benefits	\$ millions	484	473	439	441	464
Capital Expenditures	\$ millions	487	595	490	518	531
Products						
High Priority Products with Product Risk Profile	percent	100	100	100	100	100
Incidents of Non-Compliance (e.g., Product Recalls and Allegations) Concerning the Health and Safety of Products	count	0	0	0	0	0
Products Subject to Information Requirements	percent	100	100	100	100	100
Environment						
Environmental Compliance						
Regulatory/Permit Exceedances ⁴	count	3	3	4	5	10
Air Quality						
Nitrogen Oxides (NO _x) ⁵	tonnes	5,403	4,976	5,344	5,388	4,464
Sulfur Oxides (SO _x) ⁵	tonnes	2,460	1,924	1,100	921	520
Volatile Organic Compounds (VOCs) ⁵	tonnes	1,614	1,851	1,383	1,392	1,201
Climate Change and GHG Emissions						
Direct GHG Emissions (Scope 1) ⁵	tonnes carbon dioxide (CO ₂)	3,514,000	3,493,000	3,454,000	3,471,000	3,054,000
Energy Indirect GHG Emissions (Scope 2) ⁶	tonnes CO ₂	798,000	799,000	785,000	758,000	741,000
Direct GHG Emissions Intensity ⁷	tonnes CO ₂ /tonne of product	0.71	0.73	0.69	0.65	0.63

n/a – not available

NOTES:

Data is typically not provided for assets/companies that we acquire until after the first full year of ownership to enable full integration of systems. As a result, safety and environmental for 2017 excludes performance from our Geismar facility. However, employee and financial data is stated as of December 31, 2017 and it includes our Geismar business since the date of acquisition (July 6, 2017).

1. Non-Accident Releases (NAR) are the unintentional releases of a hazardous material while in transportation, including loading and unloading while in railroad possession, that is not caused by a derailment, collision or other rail-related accident. This definition is aligned with the [AAR Non-accidental Release Program](#).
2. Recordable Distribution Incidents are unplanned events involving a carrier transporting NOVA Chemicals' commodity or raw material that may result in undesirable consequences. Incidents include accidents, near hit events, spills, unsafe conditions, media involvement, potential community or environmental impacts. Recordable incidents are any serious events that exceed our cost threshold and/or have at least a moderate impact on our business.
3. All Reported Material Distribution Inquiries includes all events recorded in the NOVALERT Transportation Incidents Log. Most of the events were reported via our transportation emergency phone line, which is primarily intended for transportation of dangerous goods emergencies, but is also listed as our company 24-hour phone number. The log includes calls requests for information and other inquiries that are not related to emergencies or incidents
4. Regulatory/Permit Exceedance (RPE): includes reportable spills and other non-compliances with federal, provincial/state, or municipal approval, permit, or regulatory requirements with potential for adverse impact. This metric excludes administrative non-compliances and reports to the regulator related to minor issues such as instrument downtime, labeling and signage.
5. The reduction in air emissions since last year was caused by a production decrease related to a planned shutdown, and by the continued reduction in liquid fuel combustion at the facilities in the Sarnia-Lambton area.
6. The 2016 figure has been restated since the publication of our 2016 Sustainability Report due to recalculations that reflect that one of our facilities is now connected to the Midcontinent Independent System Operator (MISO) grid instead of generating onsite electricity from coal.
7. The reduction in GHG intensity since 2016 is mainly attributed to efficiencies at our Joffre, Alberta site that included running the cogeneration plant to operate close to designed specifications.



To learn more about NOVA Chemicals, please visit:

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For questions or comments, please contact:

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