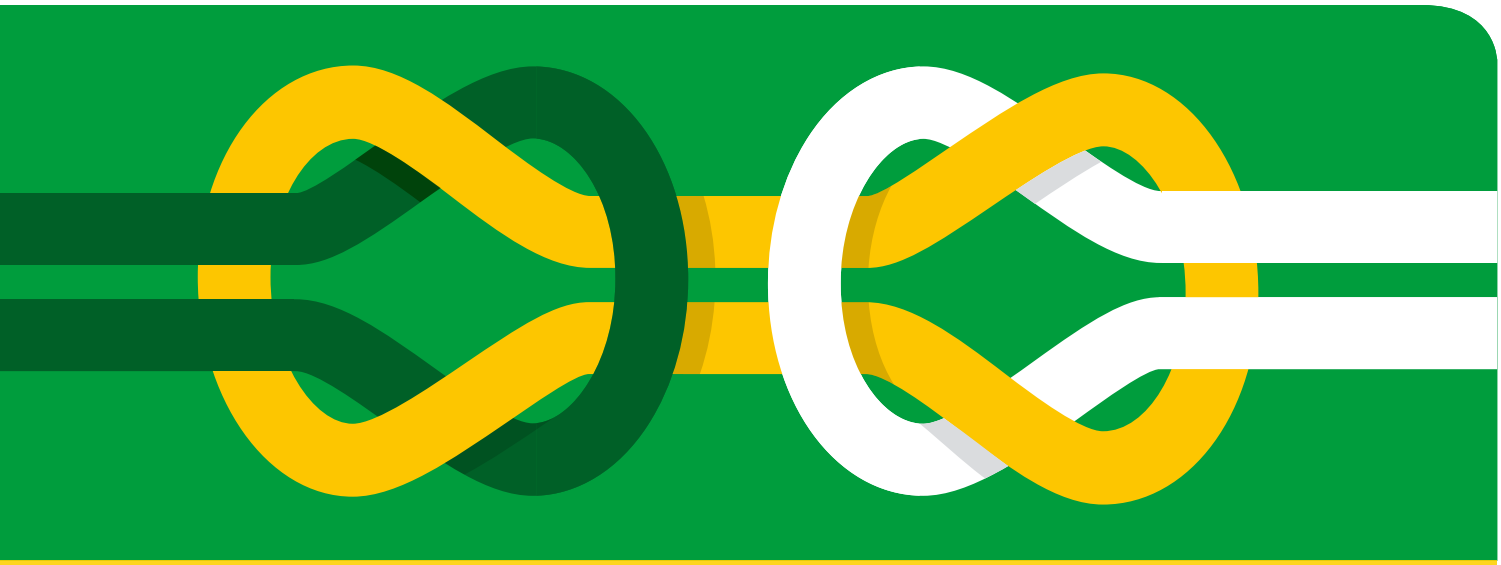
TEIJIN

Human Chemistry, Human Solutions



HSE Report 2016

Welcome to the Teijin Aramid Health, Safety and Environment (HSE) Report 2016.

Teijin Aramid aims to be the global leader in aramids, and we believe that sustainable value creation is part of this ambition. To this end, we focus on being transparent about the impact of our activities on people and the environment, and we report openly on how we contribute to a more sustainable world. We have observed that our customers increasingly want and need to operate in a more sustainable way. Teijin Aramid fully supports this development. However, we also believe that sustainable solutions should be financially viable and make good business sense.

Over the past 10 years, we have developed and continuously improved our eco-efficiency approach. This is our way of demonstrating that our products are both eco-efficient and cost-efficient throughout the value chain. Over the years, this approach has gained more and more recognition.

Because we are part of Teijin Ltd, our performance in terms of corporate social responsibility is reflected in the Teijin Group Integrated Report 2016. In addition, in this HSE report, we provide specific insight into Teijin Aramid's HSE performance, while also reflecting on some of our eco-efficiency highlights in 2016.

We would very much like to receive your feedback on this report, so that we can make relevant improvements next year. Please send us your views, comments or observations by submitting the online contact form and we will get back to you. Any feedback will be greatly appreciated.

Happy reading!

Health and Safety

Health and safety are our main priorities in the development and manufacturing of our products. Our core business involves the handling of hazardous chemicals and machinery, and it is of crucial importance that our employees and contract workers, as well as people living in the neighbourhood, always remain safe.

We identify two key areas of safety: labor safety and process safety. In addition, we also pay a lot of attention to the general health of our employees and risk management in general. In all these three areas, various programs are running in order to improve the safety of our working environment and to help our employees to stay healthy.

Safety within Teijin Aramid

With regard to safety, we aim to be among the best in class. We want our employees and contract workers to return home from work safely, every day. Following an assesment in 2013 we concluded that we needed to step up from being a calculative safety culture to a proactive safety culture in 2018. In order to achieve this, we developed several programs to improve our level of both labor and process safety.

Labor safety

Behavior-based safety

To help us create a more proactive safety culture, in 2016, we explored the concept of Brain Based Safety, which focuses on the underlying principles of behavior. Together with our managers, these principles were reviewed and discussed. We then set up a pilot to train shift workers as safety coaches. In 2017, we will evaluate this approch and how it contributes to our ambitions being a proactive safety company.

Systems

Besides considering our culture and behavior, we also focus on making smarter and more efficient use of our internal systems. For example, we are currently designing a new system to manage training programs for individual employees (including safety training programs and safety instructions). In addition, we further improved our online HSE reporting database in 2016, which led to an increase in the number of reports regarding (potential) unsafe situations made. We are proud of this: it shows that employees are increasingly aware of potentially unsafe situations and are willing to share their insights so that the entire organization can learn from them. It also improves ownership and the speed of taking action.

Exposure to chemical substances

We continue to give high priority to preventing exposure to chemical substances, particularly sulfuric acid in Emmen. In 2016, much attention was paid to the use of new PPE (personal protective equipment) for those working with sulfuric acid. For example, we purchased new air-flow face shields, which means operators are even better protected.

Maintenance shutdown

In 2016, there was a major maintenance shutdown at Delfzijl, which lasted several weeks. Such events are always intense, as a lot of people working simultaneously on many different parts of the installations, and they have only a relatively short amount of time to complete their work. In total, about 100,000 hours were spent on maintenance activities by our own employees and contractors. During this maintenance shutdown, there was a clear focus on working safely. Thanks to daily consultations, consistent risk analyses before the start of activities, and proactive reporting, the shutdown was completed in time whithout any reportable incidents.

Process safety

Since 2013, we have worked in conformity with the international CCPS standards. In the past few years, we carried out scans on 20 different aspects of our organization. In 2016, we focused on topics such as compliance and workforce involvement.

Compliance

In collaboration with an external agency, we screened our locations for compliance with all relevant sections of the law (more than 3,000). The ultimate goal is to ensure that, in practice, we work in conformity with the most recent laws and regulations. All our registers are now up to date and any adjustments will be checked every six months, a procedure that is now incorporated into our QHSE management systems.

Workforce involvement

We attach great importance to involving all employees when it comes to safety issues. In practice, this means holding regular work meetings and internal audits, regular consultation with the works council, having instructions written by the users themselves, emergency drills, and more. In total, there are 52 different aspects in which the workforce is involved. In 2016, at Delfzijl, these were all internally evaluated in terms of workability and degree of implementation.

Earthquake dossier

Specifically for our location at Delfzijl, earthquakes caused by gas extraction are a topical theme. In 2016, in collaboration with neighboring companies, public authorities and knowledge institutes, we started compiling an earthquake dossier. So far, our Delfzijl site has not suffered any (man induced) earthquake-related damage. The collaboration mainly focuses on mapping the current state of affairs in order to be prepared for any future developments.

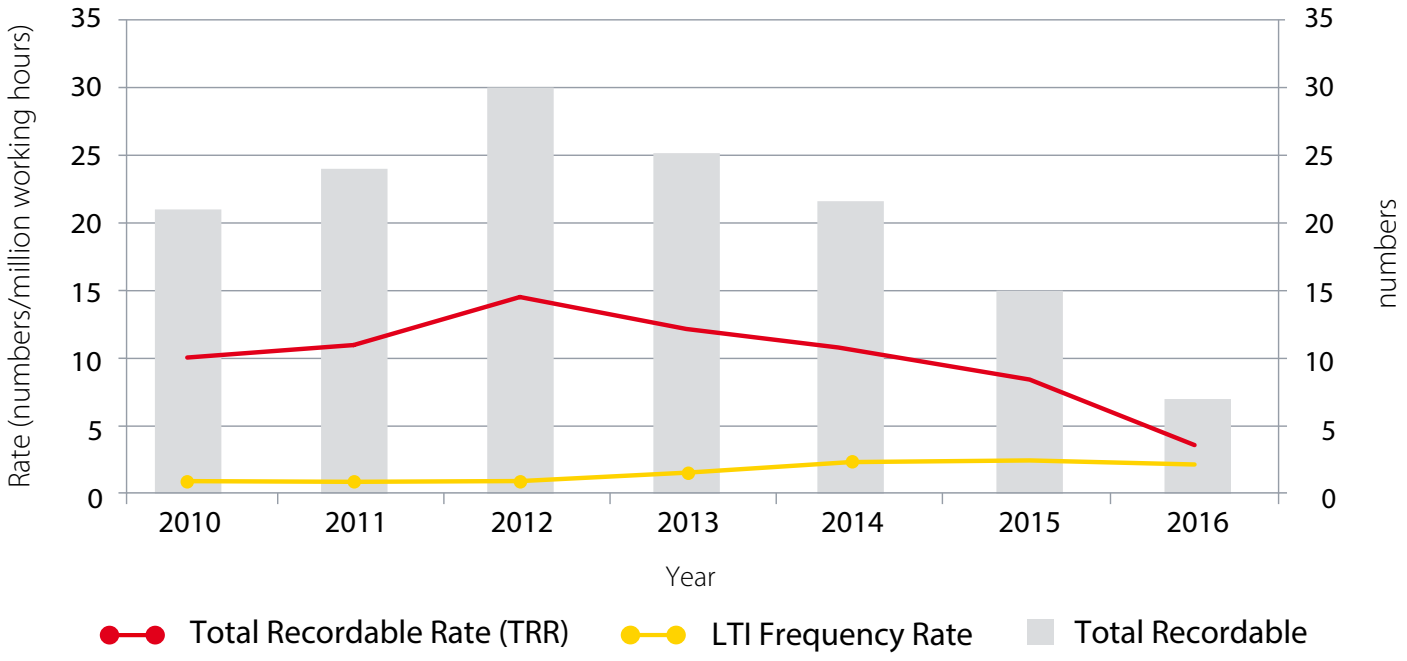
Safety performance 2016

Despite all our efforts, hazardous situations may still may occur and incidents can happen. We do everything we can to prevent this, as we believe that each incident is one too many. We measure our safety performance based on the following data:

1. Incidents leading to absence (Lost Time Injuries- LTI)
2. Incidents leading to temporary alternative work (Restricted Work Cases- RWC)
3. Incidents requiring medical treatment (Medical Treatment Cases- MTC)

Using this information, we calculate the Total Recordable Rate (TRR), which is the total number of incidents (the total of Lost Time Injuries, Restricted Work Cases and Medical Treatment Cases) per one million working hours.We also calculate our LTI frequency rate, which is the total number of incidents leading to absence per one million working hours.

Safety incidents



Safety targets

In order to be able to measure the effect of our improvement programs, we have set ourselves the target of an overall total recordable rate (TRR) of under 8. In 2016, our TRR was 3.6. Over the years, we clearly see a declining TRR trend. This shows that we are working on the right issues. Nevertheless, our ultimate goal will be to see our efforts translated into a reduction of LTI's to zero.

For 2016, the Teijin Group had set itself a target of keeping the Lost Time Injuries (LTI) frequency rate under 0.30. This is the number of serious industrial accidents resulting in serious injuries and leading to absenteeism per one million hours worked. A serious accident is defined as an accident resulting in serious injuries, such as permanently torn muscles or tendons, significant fractures, and worse. In 2016, within Teijin Aramid no such serious accident- related LTI's occurred.
In addition, within Teijin Aramid, we monitor all incidents that lead to lost time. These also include incidents resulting in, for example, a sprained ankle, cuts, and other relatively light injuries. In 2016, we recorded a total of 4 LTI's, resulting in a total LTI frequency rate of 2.07. We also monitor the LTIs of our contractors. In 2016, one contractor reported one LTI.

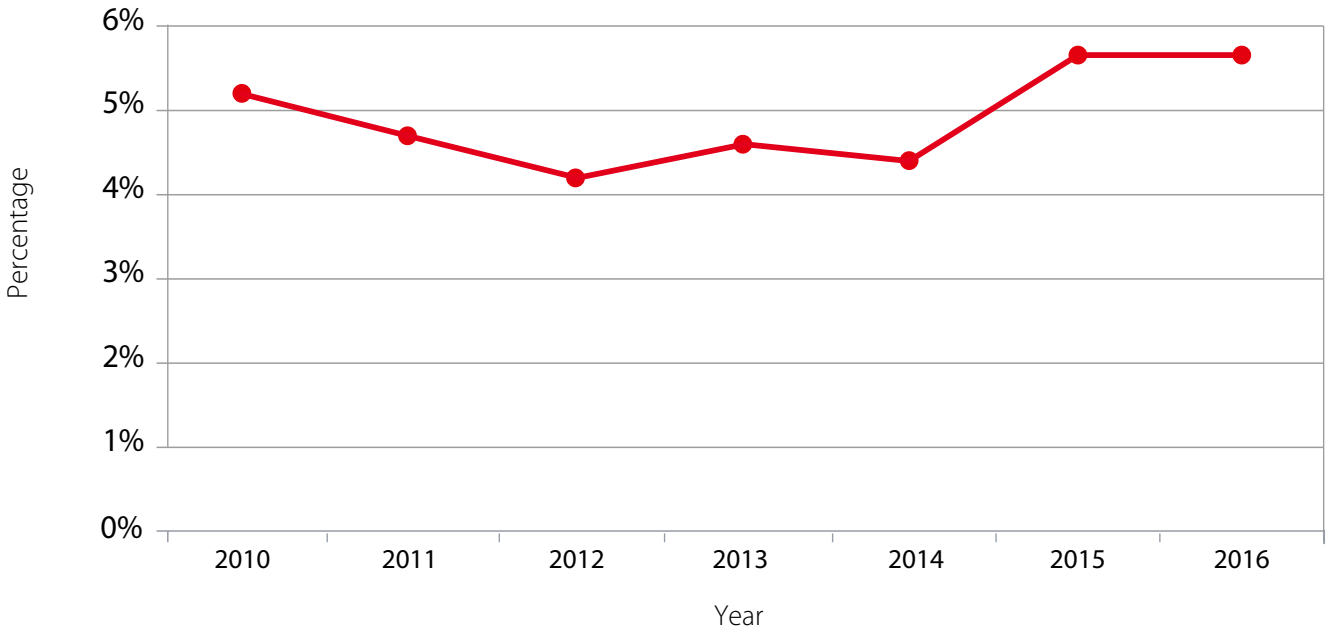
As every LTI is one too many, our ultimate aim is zero LTIs. Over the past few years, our LTI frequency rate has stabilized, but we still aim to improve our performance through the various improvement programs we have in place.

Health

The health of our employees is very important to us. One of the ways we measure our performance with regard to our employees' health is our 'Absence due to illness' rate. This rate was 5.6% in 2016.

This is significantly higher than what we aim for: to stay below a rate of 4.5%. The main reason for this year's higher rate is an unfortunate increase in long-term illness. Factors that play a role here include the ageing of shift workers, physical workload, and personal fitness. Going forward, we will continue to focus on improving the situation, with the main aim of staying below an absence due to illness rate of 4.5%.

Health related absences



In 2016, in Emmen and Delfzijl, we started working with a new occupational health and safety service. In 2017, our locations in Arnhem will also switch to this service provider. By choosing to work with a single occupational health and safety service, we aim to take the same structured and uniform approach to absence for all our employees.

Besides switching to a new service provider, our health policy is increasingly becoming a comprehensive 'vitality policy' focusing more on prevention, with a continuous focus on finding solutions to problems that hamper employability. Our organization increasingly requires our employees to be flexible, while the average age of our people is rising. This means that we will need to focus more on how our employees can become – and stay – more energetic and resilient. By making use of our occupational health service's specialized " vitality coaches", we can improve people's employability in the longer term and prevent absenteeism.

In addition, to prevent absence due to illness, employees will be able to use the sustainable employability budget from the collective labor agreement. In this context, as of 2017, we will make various 'vitality interventions' available to our employees.

Energy and Environment

Besides taking care of our employees, we also consider our own environmental impact. This impact is mainly caused by the raw materials we use, our emissions and our energy consumption. In the manufacturing of our products, we aim to recycle our raw and intermediate materials and process aids as much as possible. In order to minimize the intake of raw materials, our production processes are designed with various closed loops.

Our environmental impact is also affected by our energy consumption. Although recycling of solvents and intermediates saves intake of raw materials, this process is also more energy-intensive. Reducing our energy consumption is a key focus area. As we are part of Teijin Ltd., we follow the Group's strategy and policies. The impact of these strategies is reflected in the Teijin Group Integrated Report 2016. Of course, we work in compliance with Dutch law and regulations. We are transparent about our impact on the environment and report on our energy and water consumption, emissions to air and water, waste, and the eco-profile of our products: our Product Carbon Footprint.

Energy

In manufacturing our products, we pay a lot of attention to ways of reducing our energy consumption in order to reduce our ecological footprint, combined with the additional benefit of cost savings.

Since 2009, Teijin Aramid has participated in the MJA-3 covenant, which involves long-term agreements between the Dutch government and companies on the efficient use of energy. The objective is to achieve an annual average of 2% energy efficiency savings. The implementation of these agreements are defined per location in Energy Efficiency Plans (EEPs). In 2016, we worked according to our EEPs 2013–2016. For this EEP period, we defined various projects with the aim of reducing the energy consumption of our processes in our plants and research facilities (process energy savings). This includes the supply of our raw materials. In addition, the application of our product in the value chain also reduces energy consumption (chain energy savings).

For the period 2013–2016, and in accordance with our MJA-3 commitment, all planned projects combined should lead to at least 8% energy savings. Teijin Aramid's goal for this 4-year period was more ambitious: an overall energy reduction of 15.4%, divided between energy savings within our manufacturing processes and energy savings achieved in the value chain by application of Twaron in end products. We set this more ambitious target because Twaron's properties (light and strong) are particularly suited to contributing to chain energy savings.

Every year, our performance is monitored by the authorities. We are pleased to conclude that we far exceeded the 8% target, and that we almost achieved our internal target of a total reduction of 15.4%. Besides achieving process savings of 7.6% (including the supply of our raw materials), we also achieved chain energy savings of 7.6% through the use of Twaron, resulting in a total reduction of 15.2%.

In 2016, we also worked on our new EEPs for the period 2017–2020. For this new period, we aim to achieve additional energy savings of 6.5% within our manufacturing processes, as well as an additional 1.5% savings in the value chain through the use of Twaron. The latter target is mainly related to the application of Twaron in conveyor belts in the mining industry.

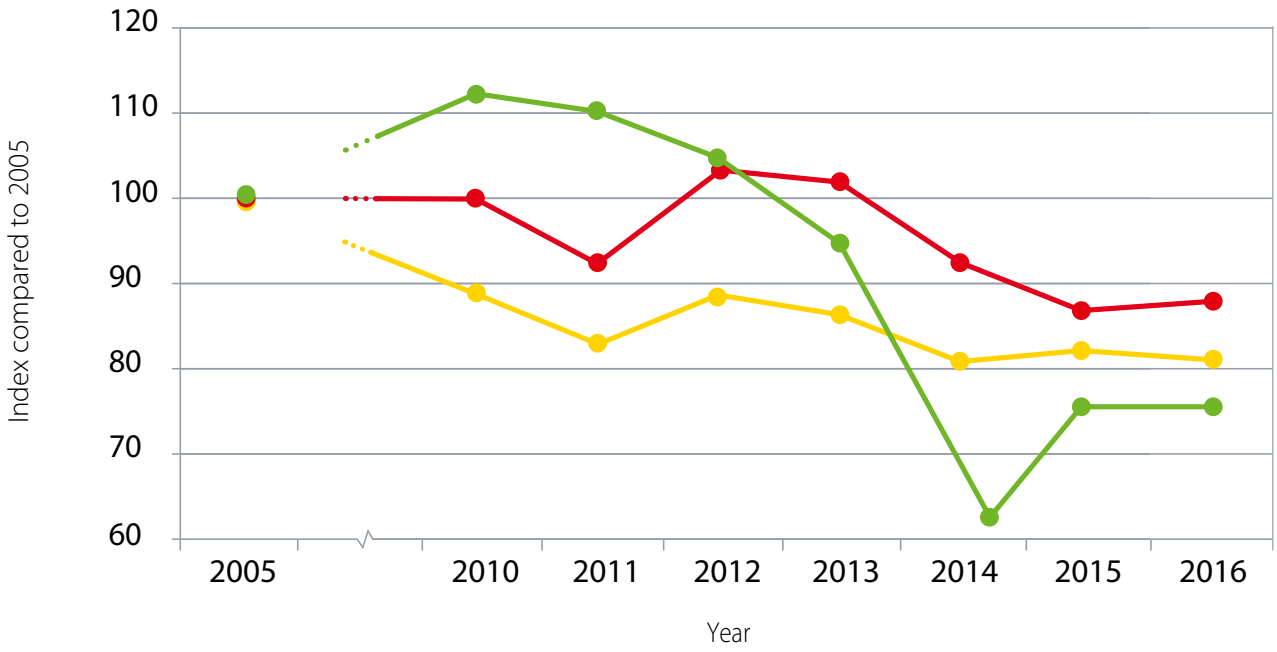
We see that, over the years, the 'low-hanging-fruit' measures to reduce energy consumption in our processes have been taken. In defining new measures, we therefore need to take a more in-depth look at our processes. In 2016, we did this together with internal and external experts. Going forward, we will need to change our approach and shift our focus to decarbonization (reduction of our CO2 emissions). This change of perspective means that, besides our continued focus on energy reduction, we will also take into account our energy and materials supply, as well as current process and product design.

A new aspect of our EEP 2017–2020 is the implementation of our Energy Management System as part of our current ISO 14001 way of working.

Our energy performance 2016

We express our energy consumption by means of the Energy Efficiency Index (EEI). This is the total energy consumption per tonne per site, compared to 2005.

Energy efficiency index



Both Arnhem and Emmen show the expected levels of energy consumption. The Delfzijl figures deviate slightly in 2016, due to a large maintenance shutdown. Our production levels show that we were able to reduce energy consumption in conformity with our EEP plans. However, due to inefficiencies caused by the maintenance shutdown, overall we consumed slightly more energy than planned.

Emissions to air

In order to minimize and control our emissions to the air, we have various installations in place, such as filters, carbon beds, and scrubbers. We have optimized our processes as much as possible. Nevertheless, we have several emissions to the air, all well within our permitted levels.

Significant deviations are explained below.

Air emissions	Location	2010	2011	2012	2013	2014	2015	2016
Component (in kg)								
Polymer dust and other particulates	Delfzijl	999	884	1148	1143	1070	991	1029
	Arnhem	52	17	15	8	8	2	36
Tetrachloromethane	Delfzijl	103	145	301	81	184	667	145
Aniline	Delfzijl	81	23	26	21	20	20	436
Dichloromethane	Delfzijl	1059	1609	1051	1839	894	366	10
	Arnhem	1468	1401	1000	480	0	20	20
Freon 22	Emmen	239	398	180	240	120	0	800
Freon 507	Emmen	490	49	0	245	147	98	245
Nitrogen oxide (tons)	Delfzijl	11	12	11	11	12	9	8
	Emmen	1	2	2	2	2	2	2
	Arnhem	1	1	1	1	0.7	0.4	0.4

Particulates

At our Arnhem location, the method to calculate our particulate mass balance was slightly adapted, which led to improved accuracy. This explains the deviation compared to the previous years. All emissions are well within our accepted levels, which is why we have not corrected the emissions of our previous years.

Tetrachloromethane

When manufacturing TDC in Delfzijl, we use tetrachloromethane as a process agent in the production of our aramid polymer. Even though the process is basically designed to emit no significant quantities of tetra, there are always small emissions, including emissions caused by what are known as 'diffuse' sources. These are emissions that are not directly related to a specific location. We have optimized these levels, which normally vary between 75 and 150kg/yr.
In 2016, we operated within normal operation levels. In 2015, the high emission of Tetrachloromethane was the result of an incident, which explains the deviation between 2015 and 2016.

Dichloromethane (DCM)

Even though our processes that use DCM are basically designed to emit no significant quantities of DCM, there are always small DCM emissions caused by 'diffuse' sources. Maintenance can have a significant effect on these diffuse emissions. Good control of maintenance procedures helps to minimize emission levels. In 2016, there was an extensive maintenance shutdown in Delfzijl. Due to strict control of all activities, DCM emissions levels were within the normal operation range.

Freon 507

Freon 507 is used as a cooling medium in Arnhem and Emmen. We measure our emissions when we refill the cooling medium by measuring the required amounts.

In Arnhem we did not refill in 2016, explaining the zero emissions. The increased levels in Emmen were the result of a leakage incident at one of our pressure valves. The cause of this leakage was unexpected corrosion. Our installations in Emmen are specially designed for an acidic environment, and all our piping is made of stainless steel. Where required, an extra coating is applied. In the case of the valve in the leakage incident, the coating proved to be inadequate, resulting in increased corrosion. Due to the incident, all piping was (re) checked and, where applicable, a new coating applied.

Emissions to water

In order to minimize and control our emissions to water, we have various installations in place, such as filters, separators, carbon beds, strippers, and water purification plants. However, there are still some emissions into public water, which regulated in relevant permits.

In Delfzijl, a part of the wastewater is discharged directly into public water. The other part is sent to a local wastewater purification plant for further treatment. In Emmen and at our production location in Arnhem, all production and wastewater is sent to a water purification plant on site, prior to discharge into public waters.

The table below shows our emissions into public water, which are all well within our permitted levels.

Emissions to water	Location	2014	2015	2016	
Component (in tons)					
Chemical Oxygen Demand (COD)	Delfzijl	57	60	48	
	Emmen	5.1	4.5	5.8	
	Arnhem	15	7.0	6.1	
Total Nitrogen	Delfzijl	5.1	5.6	4.6	
	Emmen	0.5	0.4	0.4	
N-methylpyrrolidone	Delfzijl	1.7	2.1	1.9	
	Arnhem	0.0	0.23*)	0.17	
Sulfate	Delfzijl	54	49	46	
	Emmen	226	237	231	
	Arnhem	70	57	49	

*) We report on NMP levels in the water as discharged into public water. For Arnhem, we have corrected the values of 2015, as last year we reported on NMP levels in our water prior to purification.

All emission levels are within our normal range of operation, and no incidents occurred.

NMP

In the polymerization of aramid, we use NMP as a processing aid. After polymerization, we recover the NMP, and we reuse the NMP in order to minimize our NMP intake. Until 2015, Arnhem had its own NMP recovery unit. In order to improve our efficiency, however, we closed our NMP recovery unit in Arnhem. We now collect our wash water, containing NMP, from Arnhem in mobile tanks and send these tanks to the NMP recovery unit in Delfzijl, where it is treated, and the NMP is reused again. The Delfzijl recovery unit has more than enough capacity to handle the (slightly) increased flow, which explains the stable emission levels in Delfzijl.

Sulfate

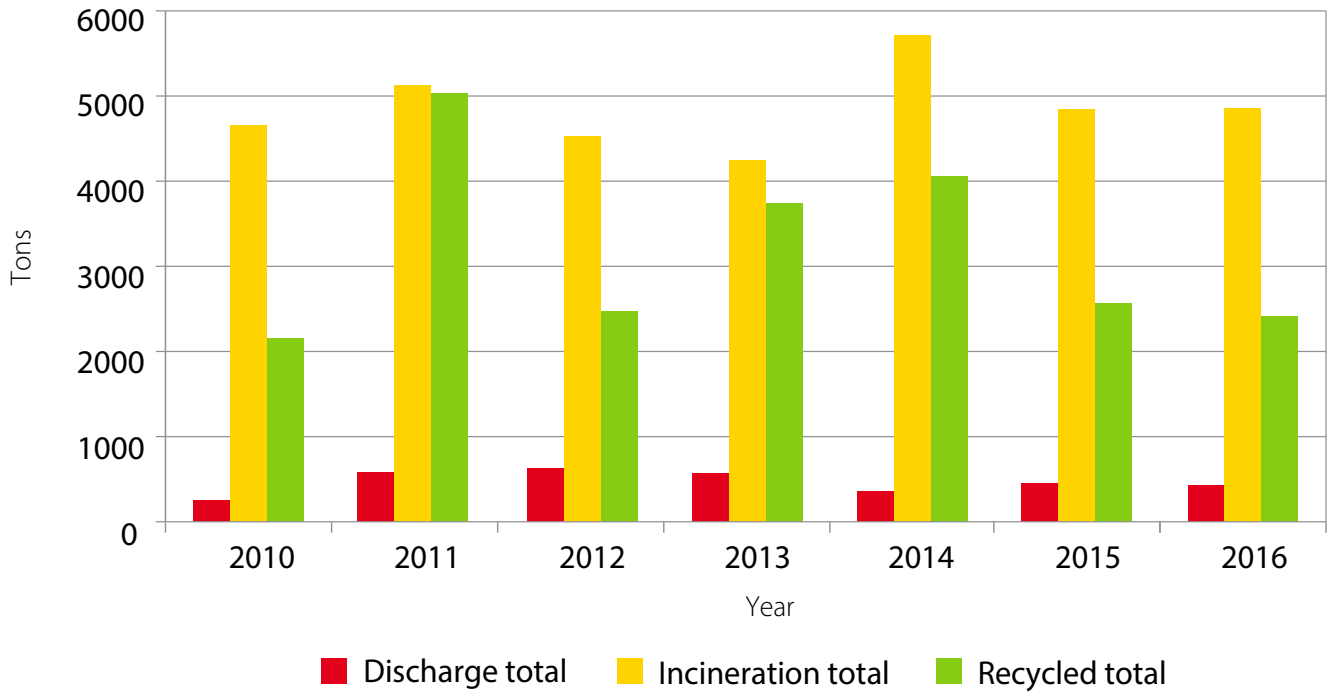
The figures for Arnhem refer to our Research location at Velperweg.

Waste and recycling

In the manufacturing of our products, we aim to recycle materials as much as possible within our processes. Our production processes include various closed loops, which not only results in reduced emissions, but also, and more importantly, optimizes the extent to which we can reuse our material streams, thereby reducing our eco footprint.

In spite of our closed loop approach, our production plants still produce waste that we need to dispose of. At all our locations, this waste is either offered for recycling or sent to incinerators. Our factory in Delfzijl is the only one of our plants that also discharges part of its (non hazardous) waste as landfill (indicated in the figure below as 'discharge total').

Total waste



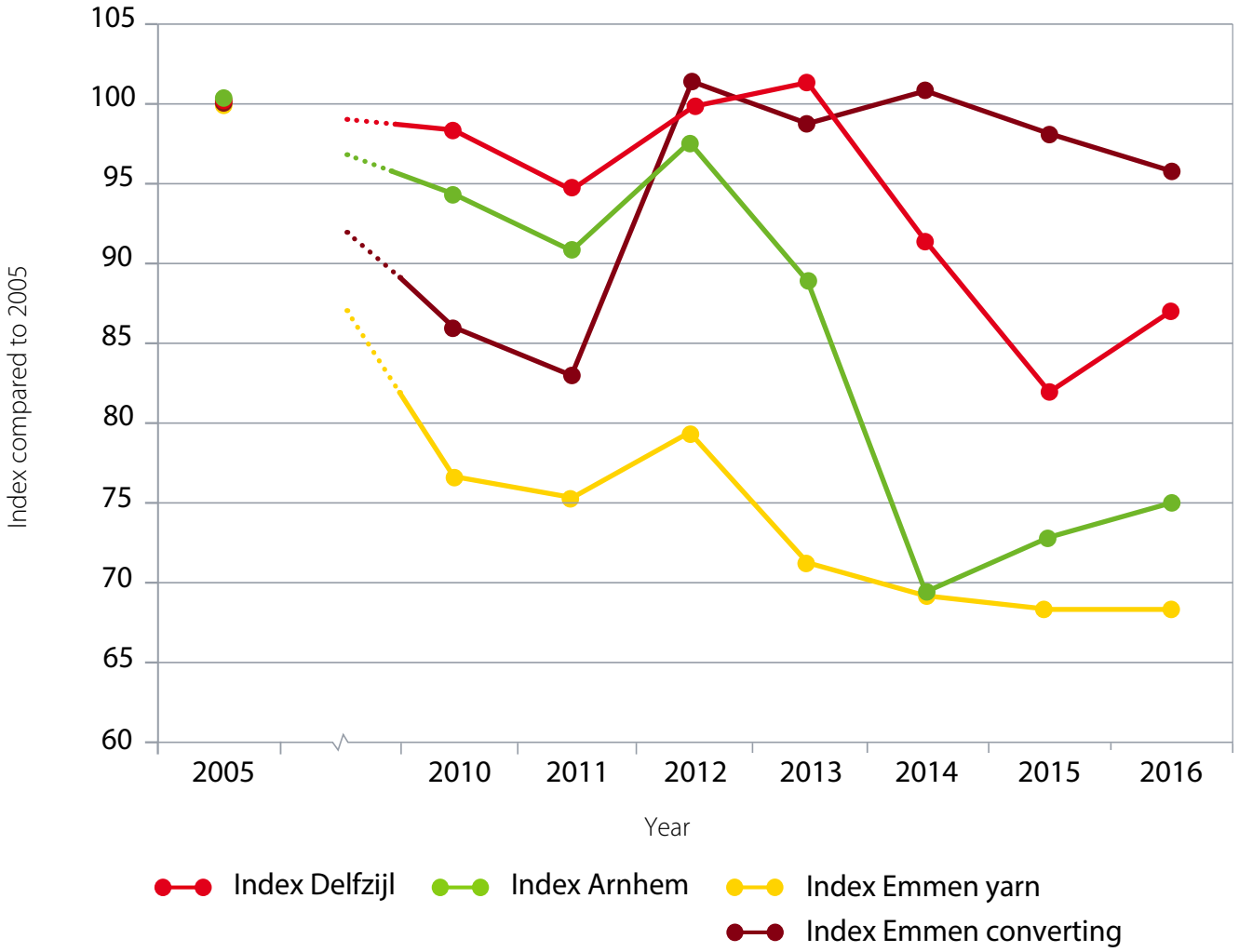
The overall values show no significant changes compared to 2015. However, looking at the individual locations in more detail, we see an increased level of waste at our production facility in Emmen. This was mainly the result of a one-time discharge of Aramid pulp standard quality.

Over the past years, we have stored this pulp with the expectation that we could reuse this material. However, research has shown that the quality of the product is not good enough, which means it is not feasible to properly reuse this waste stream standard grade. It was therefore disposed of.

Water consumption

All our factories make use of recycled water. Nevertheless, additional fresh water is still needed in our production processes and facilities. We report on our water consumption by means of the water consumption index per location. This is the water consumption per tonne of production, compaired to our reference year 2005.

Water consumption index per ton product



In Delfzijl, we started an improvement project for two of our cooling towers in 2015. This resulted in a significant reduction of water consumption. In 2016, we applied these improvements to two other cooling towers. This led to a reduction of the total water consumption. However, due to the maintenance shutdown, the overall water consumption was less efficient, and the total consumption per tonne increased.

The increase in Arnhem is the direct result of a more diverse production program. Starts and stops are less efficient, leading to increased levels of water consumption per tonne of production.

Eco-efficiency: Sustainability as business driver

Teijin Aramid aims to be the global leader in aramid technology. We believe that sustainable value creation and cost awareness go hand in hand. In order to fulfill this ambition, we not only tell, but also quantify and prove, that applying Twaron in a product is both a sustainable and a cost-efficient decision: an eco-efficient decision. With our Customer Benefit Model, we compare the effect of using Twaron against other raw materials in products, by calculating both cost performance and eco-performance, over the total value chain.

Over the past 10 years, we have developed and improved our eco-efficiency approach. And this has not gone unnoticed. More and more customers are interested in this approach and in 2016 we were granted various awards, both from our customers and from our eco-efficiency peers.

Eco-efficiency: a brief summary and highlights 2016

The sustainability of a product is determined by that product's function in each link in the chain. Under the banner of 'function comes first', Teijin Aramid's Eco-efficiency Services team, together with an external partner, developed the Customer Benefit Model (CBM). This model makes it possible to calculate, in cooperation with and specifically for the customer, what the best solution will be for the customer, both from a sustainability perspective and financially.

The CBM specifically considers the application of the end-product. Most other analyses simply compare the environmental impact of producing 1 kg of aramid with that of producing 1 kg of an alternative material. Our CBM model, on the other hand, makes it possible to compare different products on the basis of the same function throughout their life cycle.

This works as follows. If you consider the entire value chain, from raw material to usage, it becomes clear that the raw materials and production of aramid are only a small part of the total environmental impact. The major part of a product's environmental impact often lies in the use of the product itself. By applying aramid, functions such as rolling resistance, weight, wear and tear, and material use can be improved significantly. These characteristics have a big effect on aspects such as energy consumption and maintenance requirements. By looking at the function of aramid throughout the end-product's lifecycle, we can calculate to what extent the application of aramid reduces the environmental impact in the chain, while improving economic returns.

This approach has not gone unnoticed. In 2016, we received international recognition when we were granted the 'Best Business Award' at the Biennial International Conference on EcoBalance in Kyoto and the 'Global Enabling Technology Leadership Award' (for our conveyor belts solutions) from leading independent market research firm Frost & Sullivan.

At Tire Tech 2016, we shared the results of the Customer Benefit Model (CBM) analysis for one of our tire customers. This revealed that the use of Twaron and a Twaron-hybrid solution for the carcass of passenger car tires were not only more cost-efficient, but also more eco-efficient.

Our customers are also convinced that the CBM approach works.

"The final results of our innovative concept tire exceeded the project's goals, delivering an average fuel efficiency improvement of 5.5% and weight reduction ranging from 23% to 37%."

Greg Bowman
Manager of Innovative Technology Cooper Tires

The eco-profile of our products: our Product Carbon Footprint

As announced in last year's report, we have switched from calculating the organizational carbon footprint to calculating the product carbon footprint: the average eco-profile of our products Twaron Yarn and Twaron Pulp.

Twaron Product Carbon Footprints per kg

In 2016, Teijin Aramid's Eco-Efficiency Department conducted an update analysis of our product carbon footprints, with the following results:

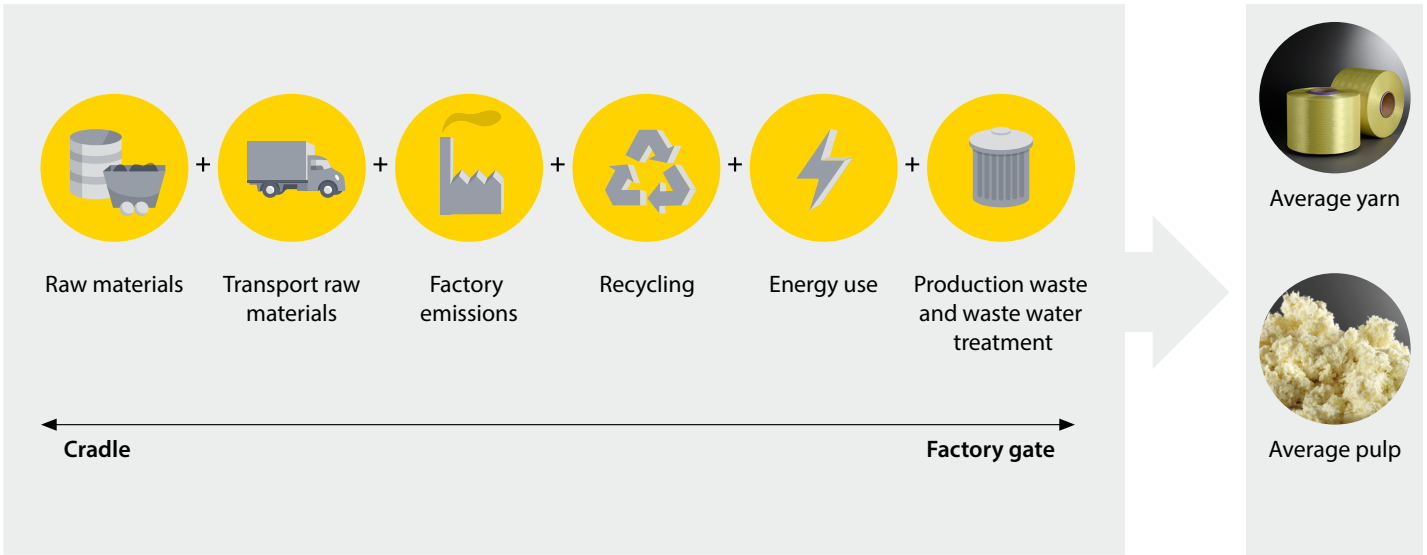
Twaron Product Carbon Footprints per kg		2015	2016	
Average Twaron Yarn	GWP[1] excl. biogenic carbon[2] [kg CO_2-eq/kg average yarn]	12.6	12.2	
Average Twaron Pulp	GWP excl. biogenic carbon [kg CO_2-eq/kg average pulp]	13.3	12.9	

Notes:
1) GWP: global warming potential
2) Other impact categories available on request.

Scope: from cradle to factory gate

The GWP values are based on the average production data from 2012 to 2014. The scope of these product carbon footprints is 'from cradle to factory gate', covering the extraction of feedstock, the production of raw materials, and the production of Twaron. The transport of the end-products to the customers, the use phase, and the end of life of the products are not included.

Scope Twaron products carbon footprint



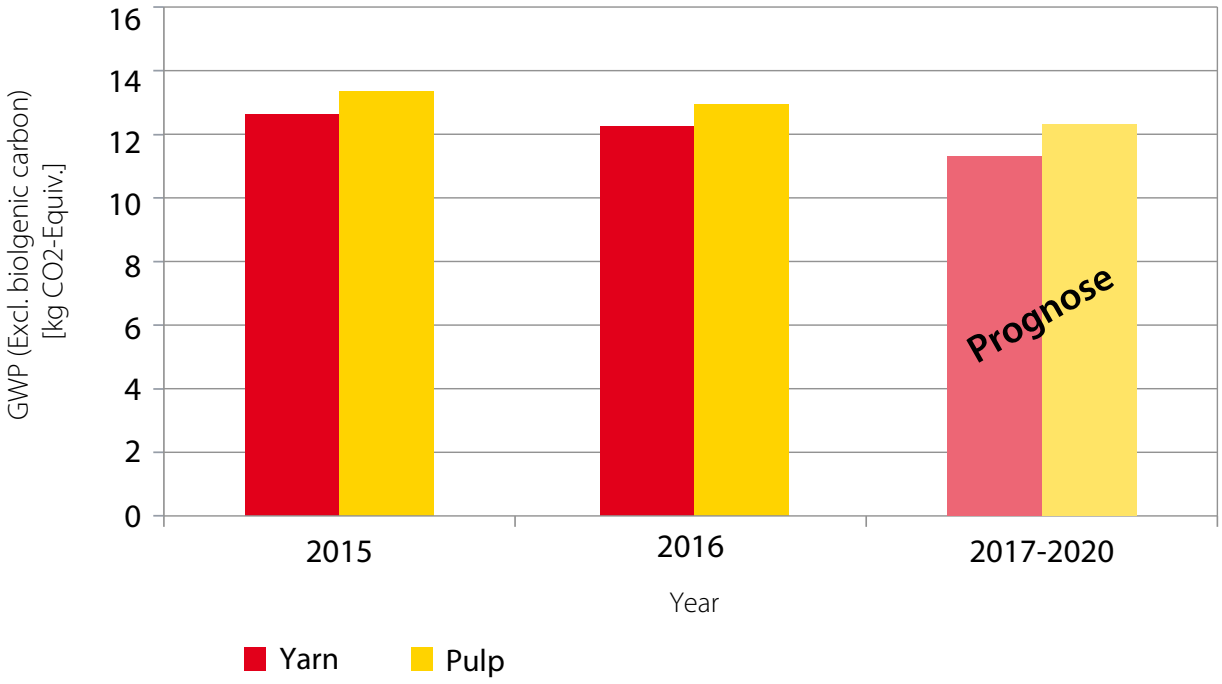
Improving our eco-profile

Part of our sustainability approach is to reduce the ecological impact of our own products. The improvement of our eco-profile is mainly the result of energy reduction and an improvement of the eco-profile of our raw products.

As our energy consumption has a significant impact on our eco-profile, we have set strategic energy reduction targets to reduce our energy consumption in our production plants. New targets and corresponding plans have been defined in our EEP 2017–2020. On bases of these targets, we expect to further reduce the Global Warming Potential of Yarn and Pulp (see graph below) between 2017 and 2020. For more information on our energy strategy and our environmental impact, see the section 'Energy and Environment'.

The effect of achieved and planned reduction measures on our product carbon footprints is reflected in the graph below.

Product Carbon Footprint development



For more information, please email
information@teijinaramid.com
or visit **www.teijinaramid.com/sustainability**