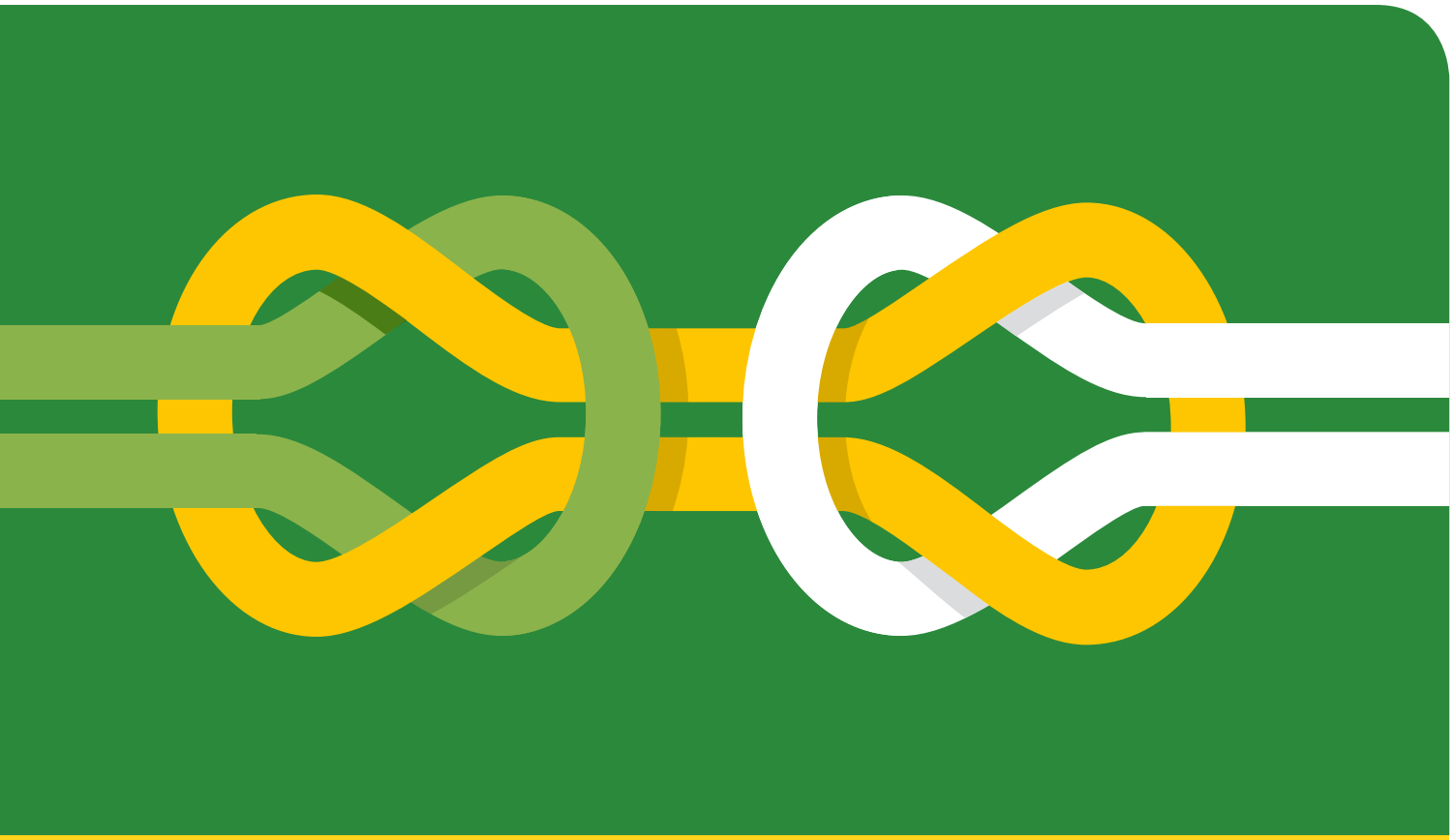
TEIJIN

Human Chemistry, Human Solutions



HSE Report 2015

Welcome to the Teijin Aramid HSE report 2015. Over the past years, we have reported on our environmental, safety, health and social performance in various ways. We started this process in 2004 and have gone through some major reporting changes over the years, both in terms of content and type of report. In addition, our mother company Teijin Ltd. has gone through some major reporting developments as well. Being one company, our aim was to integrate both reporting lines, an ambition we achieved last year.

We are proud to state that our performance in terms of corporate social responsibility is reflected in the Teijin Group integrated report 2015. At the same time, we also aim to be transparent with regard to our own HSE performance and impact, and continue to publish a Health, Safety and Environment (HSE) report specifically for Teijin Aramid.

Health and Safety

Health and safety performance

Health and safety are two key areas in our ambition, and they are our main priorities in the development and manufacturing of our products. Our core business involves the handling of chemicals and machinery, and it is of crucial importance that our employees contract workers and neighborhood always remain safe.

Our safety performance

With regard to safety, we want to be among the best in class. We want our employees and contract workers to return home from work safely every day. In order to achieve this we have developed programs to improve our level of both process and labor safety.

Process safety

In 2013, we adopted the internationally standardized CCPS method to improve our process safety level, considering the fact that our major production sites are BRZO classified. We set our ambition to be among the best in class, defined by this method, in 2020. By means of a scan, measuring our safety performance with regard to 20 different elements, the Delfzijl base line was determined and corresponding improvement projects have been defined. In 2015, the same scan was executed again, showing an overall improvement of 10% on a benchmark scale. This is in line with our overall ambition. In Emmen, the base line was measured in 2015.

On the bases of these scans, we have evaluated our safety program and adjusted if needed. We started with an overall improvement program in 2013 and we are now making the necessary steps.

Our process safety program is a combination of various technical and organizational elements. For example, we re-assess all our installations by carrying out HAZOP/LOPA studies. In addition, we run a number of programs to further improve our performance on ATEX, SIL and Proces Indicator Management as well as on operational procedures. We aim to involve all relevant stakeholders such as operations, management and external parties as much as possible.

In 2018, we will again measure our performance and aim to improve our current status by another 5%.

Labor safety

In order to determine relevant improvement projects with regard to labor safety, we evaluate the following three sources:

- The main risks emerging from safety studies and reports on unsafe situations
- Root cause analyses of incidents
- Regulations

In 2015, this resulted in the following three focus areas:

Falling/tripping/stumbling

This is one of the major causes of LTIs within Teijin Aramid, and a complex issue. Preventing falls requires a combination of safe surroundings and people paying proper attention to what they are doing. Most of the time, these incidents are not directly related to work, and the subsequent incidents are often not very serious. But they are still incidents, and therefore require our attention. In order to reduce these types of incidents, we have started a pilot in which, together with our Safety Officer, operators scan their premises for potential risks. This has resulted in several technical improvements, as well as (thanks to the involvement of the operators) increased awareness.

Direct contact with chemicals (e.g., sulfuric acid)

In Emmen, direct contact with sulfuric acid is the major cause of incidents requiring first aid and medical treatment. We pay a lot of attention to protecting our employees with the proper protective clothing.

Exposure to dangerous substances (CMR)

Following European and Dutch regulations, we have implemented a 4-step program to survey, assess, control and assure the safe use of chemicals. For instance, for our plants in Emmen and Arnhem we have identified over 400 scenarios in which exposure to different types of chemicals may occur. The subsequent health risk of each scenario was determined, and if necessary, relevant actions were taken.

In Delfzijl, our efforts in this area over the past years have paid off: for the first time in several years, there were no incidents, involving chemical substances that led to personal injury. This is mainly the result of improved preparation procedures prior to equipment maintenance.

Safety performance 2015

Despite all our efforts, hazardous situations still occur and incidents happen. We do our utmost to eliminate this, as we believe that each incident is one too many.

We measure our safety performance on the basis of the following data:

- Incidents leading to absence (Lost Time Injuries – LTI)
- Incidents leading to temporary alternative work ` (Restricted Work Cases)
- Incidents requiring medical treatment (Medical Treatment Cases)

Using this information, we calculate the Total Recordable Rate (TRR), which is the total number of incidents (i.e., the total of Lost Time Injuries, Restricted Work Cases and Medical Treatment Cases) per one million working hours.

Safety targets

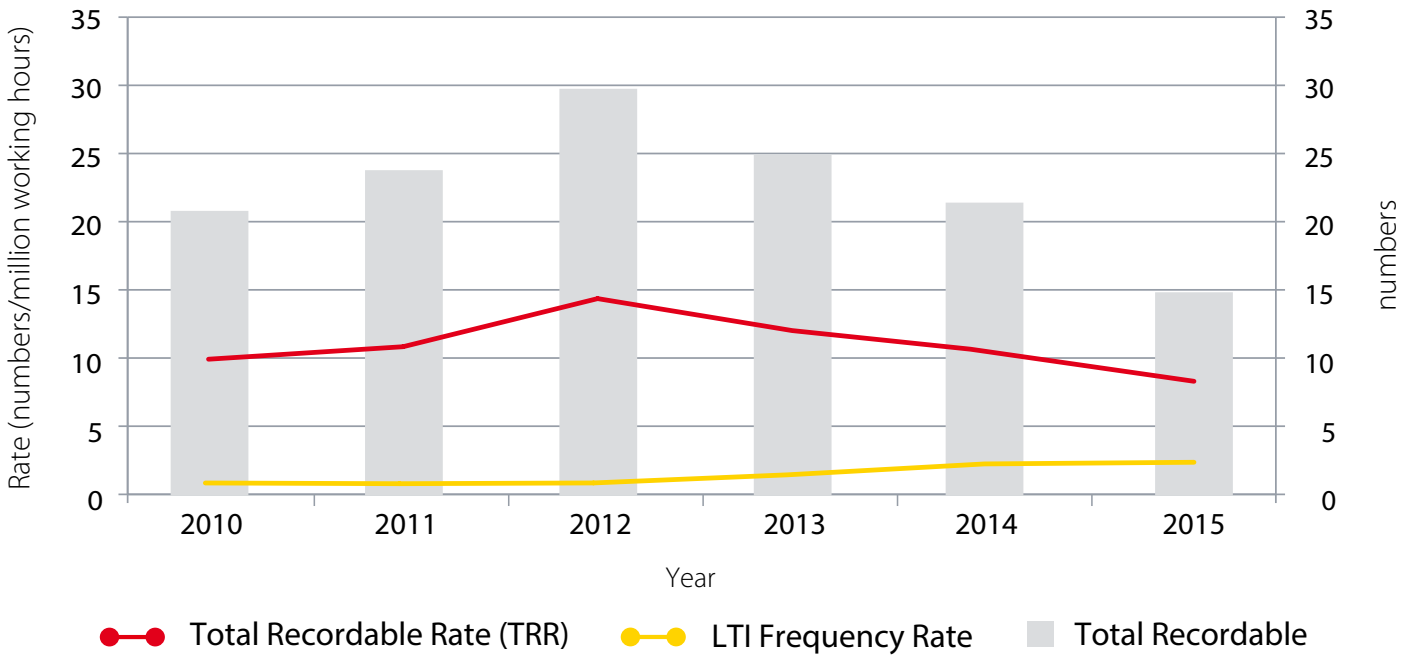
For 2015, the Teijin Group had set itself a target of maintaining the Lost Time Injuries (LTI) frequency rate under 0.25. This is the number of serious industrial accidents leading to absenteeism per one million hours worked. A serious accident is defined as an accident resulting in serious injuries, such as torn muscles or tendons, fractures and worse. In 2015, within Teijin Aramid, no such incidents occured.

Next to that, 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 2015, we recorded a total of 4 incidents, resulting in an LTI frequency rate of 2.1.

As every LTI is one too many, our ultimate aim is zero LTIs. In order to be able to measure the effect of our improvement programs, we have set a target for an overall total recordable rate (TRR) under 9. In 2015, our TRR was 8.

We also record all incidents among the employees of our contractors and subcontractors. One contractor reported one LTI.

Safety incidents

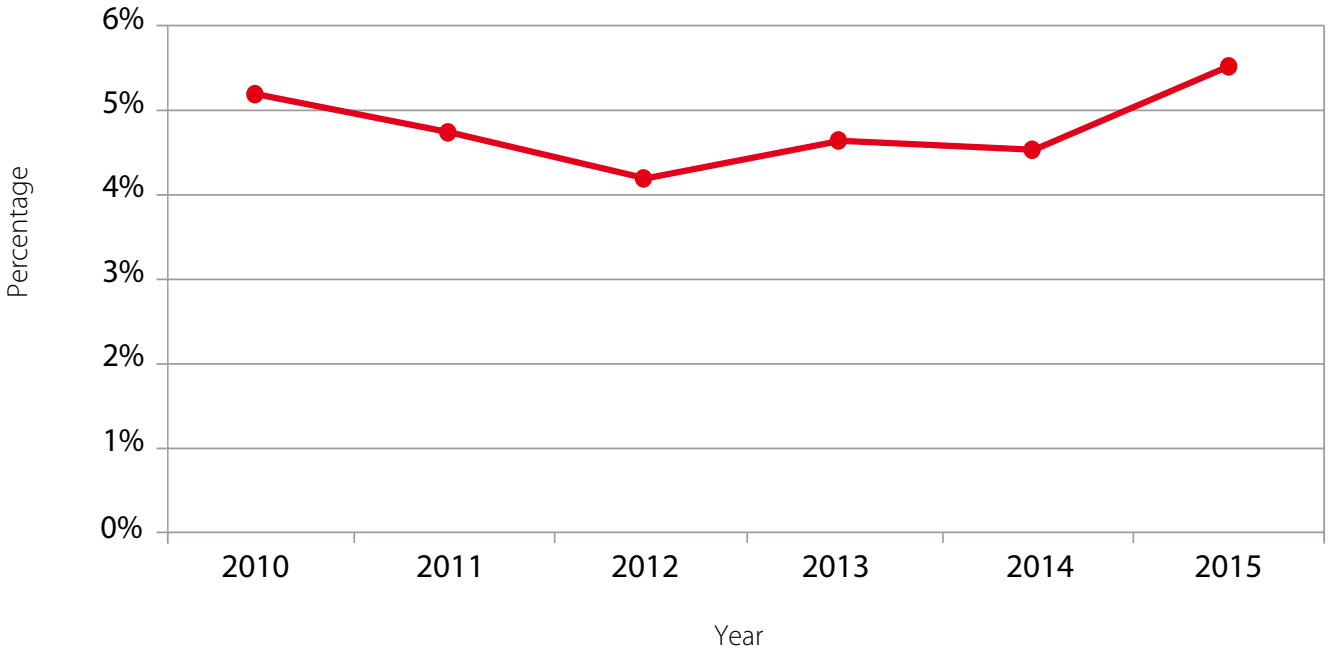


Health

The health of our employees is of key importance to us. One of the parameters to measure our performance with regard to the health of our employees is our absence due to illness rate. This rate was 5.6% in 2015. This is significantly higher than what we aim for: to stay below an illness rate of 4.5%. The main reason for this higher rate is an increase in long-term illness. We are currently investigating this increase in more detail. Age-ing of shift workers, physical workload, personal fitness and other factors all play a role here. In 2015 the first phase of our long term automation program was largely completed. The next steps are currently being prepared.

In 2016, we will also start working with a new occupational health and safety ("arbo") provider, which will give a new impulse to our health programs. This includes the introduction of "vitality coaches". These coaches will support our managers and employees with matters such as absence due to illness, re-integration and employability.

Health related absences



Environment

Energy and Environmental Performance

Besides taking care of our employees, we also consider our environmental impact. Being part of Teijin ltd., we follow their strategy and policies. However, in the execution of this policy, we also aim to be transparent about our own impact on the environment and report on our main environmental issues. These include energy and water consumption, emissions to air and water, waste, and our carbon footprint strategy.

Energy

In the manufacturing of our products, we pay a lot of attention to ways of reducing our energy consumption in order to limit our own impact on the environment and also to save costs.

For many years now, we have participated in the " MJA-3 covenant" at all our locations. The MJA-3 plans are 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 savings. The implementation of these agreements has been defined in Energy Efficiency Plans (EEPs) per location. We now work according to our EEPs 2013 – 2016. For this EEP period, we have defined various projects to reduce the energy consumption of our processes in our plants and research facilities (process savings). The application of our product in the value chain also reduces energy (chain energy savings).

The total energy reduction is therefore measured in two ways:

1. Energy reduction in our manufacturing processes
2. Energy reduction achieved as a result of the application of Twaron in the value chain.

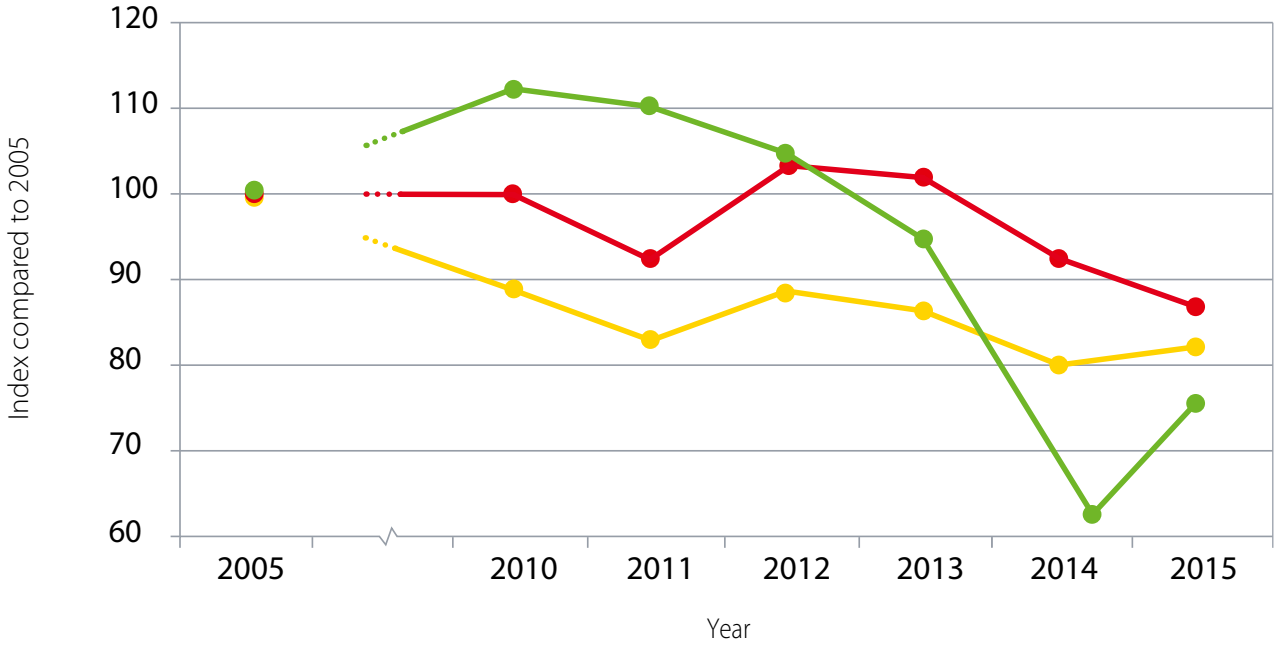
For the period 2013–2016, all planned projects combined will lead to a total of 7.5% energy savings within our manufacturing process. On top of that, we aim to achieve a total of 7.8% energy efficiency savings in the value chain through the use of Twaron.

Every year, our performance is reviewed both internally and externally by the authorities. The reviews of 2015 show that we are on track to achieve the planned savings in four years' time. Besides executing the plans for 2013 – 2016, we are currently in the process of writing our new EEPs for the period 2017–2020.

Our energy performance in 2015

We express our energy consumption by means of the Energy Efficiency Index (EEI). This is the total energy consumption per ton per site, compared to 2005. The EEI is affected by internal factors such as plant capacity and product mix, as well as external factors such as outside temperature. In spite of the energy reduction achieved through the EEP projects, these factors have resulted in an increase in the index for Emmen and Arnhem.

Energy efficiency index



Air emissions

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

Tetrachloromethane

In the manufacturing process of TDC in Delfzijl, we use tetrachloromethane (tetra) 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 "diffuse" sources. We have optimized these levels, which normally vary between 75 and 150kg/yr.

The increased emission of tetra chloromethane in 2015 is the direct result of an incident caused by a human error during operations. This incident caused approx. 550kg of tetrachloromethane to be emitted into the air. Together with the local fire department, the emission was contained very quickly and did not result in an increased risk for the surrounding environment. We have thoroughly evaluated both the cause and the consequences, and taken relevant countermeasures.

Dichloromethane (DCM)

The reduction of DCM emissions in Delfzijl is the result of normal operations. There are always some DCM emissions caused by "diffuse" sources. Maintenance can have a significant effect on these diffuse emissions. We believe that the reduction in 2015 is the direct result of the improved control of maintenance procedures.

Freon 22

In 2016, we will fully eliminate the use of Freon 22 as a cooling medium. All relevant cooling installations will be replaced by installations using carbon dioxide or ammonia as a cooling medium. The elimination of corresponding emissions is in line with this target.

Freon 507

The variation of emissions in Emmen is within the normal range of operation. The increase in Arnhem is due to normal operations. In 2014, we reported no emissions due to significantly reduced production levels. In 2015, we operated at normal levels again, resulting in emissions that increased accordingly.

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, in spite of all these installations, we have some emissions into the public waters, all well within our permitted levels.

In Delfzijl, part of our production and waste water is emitted directly into public waters. The other part is sent to local water purification plants to be cleaned. In Emmen and at our production location in Arnhem, all production and waste water is sent to site water purification plants, prior to emission into public waters. The following values are the corresponding emissions into public waters.

All emission levels are within our normal range of operation, and no incidents occurred. The increase in NMP emissions in Arnhem is the direct result of increased production levels.

Emissions to water	Location	2014	2015	
Component (in tons)				
Chemical Oxygen Demand (COD)	Delfzijl	57	60	
	Emmen	5.1	4.5	
	Arnhem	15	7.0	
Total Nitrogen	Delfzijl	5.1	5.6	
	Emmen	0.5	0.4	
N-methylpyrrolidone	Delfzijl	1.7	2.1	
	Arnhem	0.0	225	
Sulfate	Delfzijl	54	49	
	Emmen	226	237	
	Arnhem	70	57	

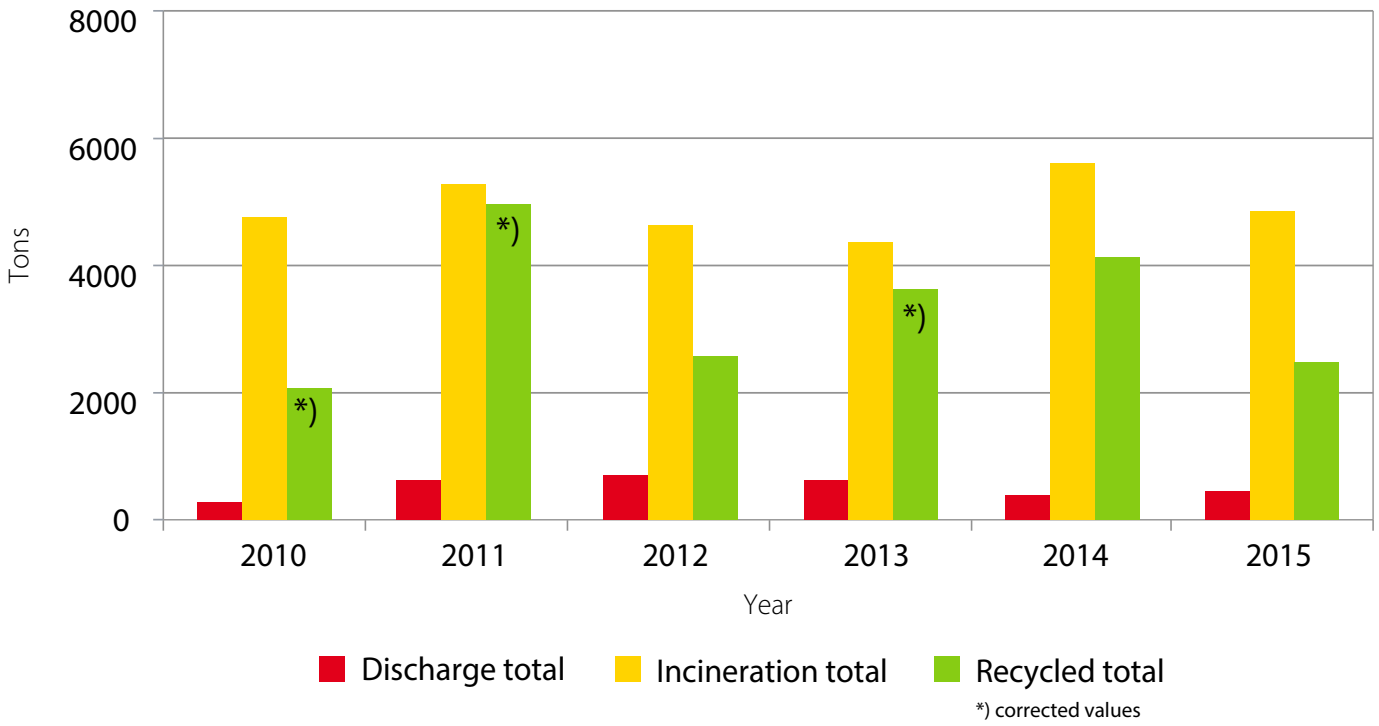
Waste and recycling

In the manufacturing of our products, we aim to recycle materials as much as possible within our processes. However, in spite of these closed loops, all our 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 waste as landfill (indicated in figure as "discharge total").

In 2015 no significant deviations occurred. The reductions in recycling and incineration are caused by the fact that the 2014 levels were higher than normal ranges.

It should be noted that the values for the recycled materials have been corrected for the years 2010, 2011, and 2013. For those years, in previous reports, we had not included the bio waste offered for recycling in Delfzijl. This bio waste is a waste-water stream that needs to be treated in a specialized biological waste-water treatment plant. The total recycled values now include all materials offered for recycling, including this bio waste-water stream.

Total waste



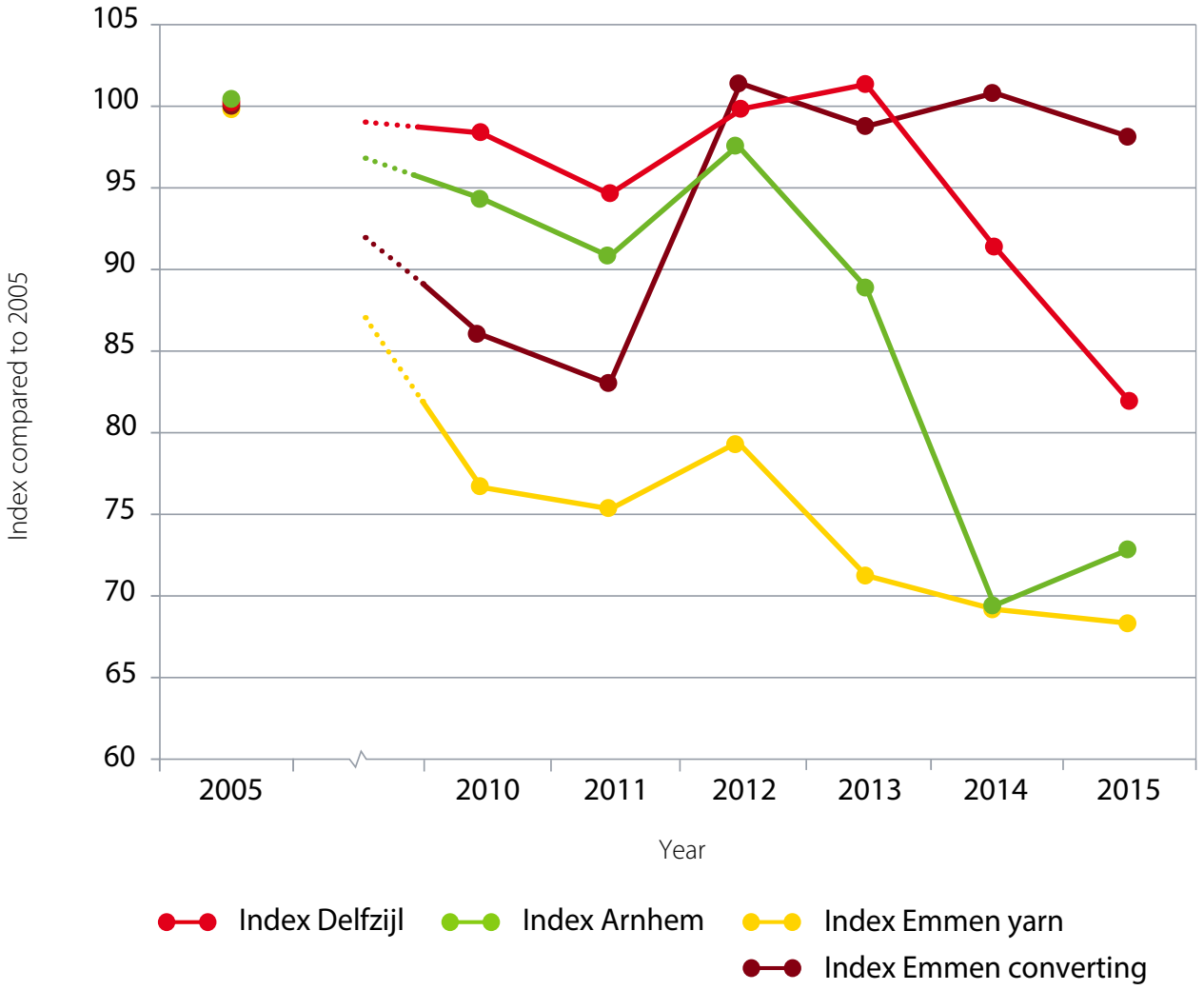
Water consumption

All our factories use (apart from recycled water) fresh water in their 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 ton of production, compared to our reference year 2005.

In Delfzijl, an improvement project on two (of our eight) cooling towers was executed, resulting in a significant reduction of water consumption. In 2016, we will review if these improvements can also be applied to the other six cooling towers.

The other locations show a normal water consumption index. The increase in Arnhem is the direct result of increased production levels.

Water consumption index per ton product



Our Product Carbon Footprint

As announced in last year's report, we shifted from the calculation of the organizational carbon footprint to the product carbon footprint.

Twaron Product Carbon Footprints per kg

In 2015, Teijin Aramid's Eco Efficiency Department conducted a study into the product carbon footprint of its key products, Twaron Yarn and Twaron Pulp. This has resulted in the following Product Carbon Footprints:

Product Carbon Footprint of Twaron Yarn: 12.6 GWP [kg CO_2-eq/kg average yarn]

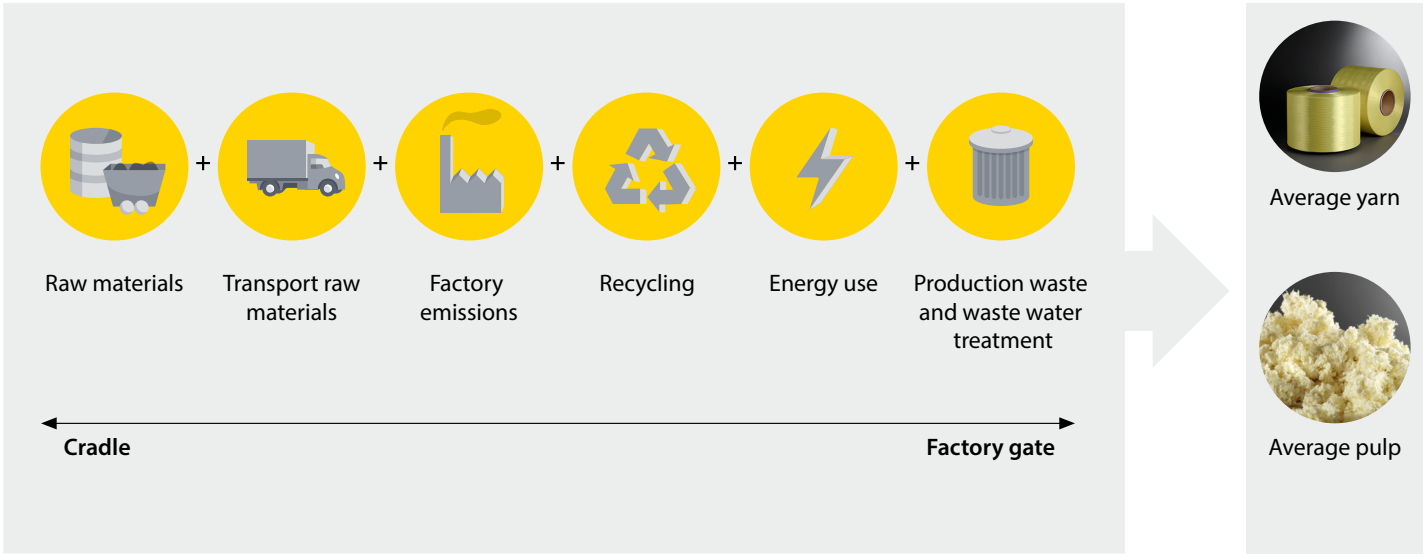
Product Carbon footprint of Twaron Pulp: 13.3 GWP [kg CO_2-eq/kg average pulp]

The published data is based on a full peer-reviewed Life Cycle Assessment (LCA) study (ISO 14040/44 compliant), which covers the full ecological footprint of average Twaron® Yarn and average Twaron® Pulp.

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 full Twaron production. 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



Integrated chain approach

One of the pillars of our sustainability approach is to quantify the total energy and material savings that can be achieved by using our Twaron solutions. Together with our customers, we quantify the environmental impact of our solutions in the chain and compare this with mainstream alternatives. We do this through our eco efficiency approach.

This "integrated chain approach" consists of two important steps:

1. Calculating the carbon footprint per kg average yarn and kg average pulp;
2. Comparing Twaron®-based solutions with mainstream solutions in terms of ecological and financial performance, together with our value chain partners, using the TUV-certified Customer Benefit Model.

These two steps connect our Twaron® Product Carbon Footprint per kg to the product function over the life cycle. For more information regarding the customer benefit model, read more.

If you would like to receive more information on the Customer Benefit Model or other Twaron product sustainability aspects, please contact a specialist from our Eco Efficiency Services team via **ees@teijinaramid.com**.

For more information, please email
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