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Editorial board: Jenni Kukkonen, Jari Haijanen, Kirsi Skyttä
Layout: Katja Ranta/Avite.fi
The Kirkniemi paper mill has been actively developing its activities in terms of environmental questions for decades. We enhance our processes continuously in a way that we can optimize production with less energy consumption, raw material usage and waste. Sustainable development and environmental responsibility are not in conflict with efficient production.

The Kirkniemi mill obtained the EMAS certificate in 2007. This is our fourth full EMAS statement pursuant to the EMAS Decree. This statement presents key information about the mill’s environmental obligations and goals, the development of environmental work and the management of impact.

A new power plant boiler was commissioned as planned
In November 2013, Sappi decided to invest in the modernisation of the power plant of the Kirkniemi paper mill. This project secures the mill’s competitiveness and also its future. The construction of the new power plant boiler was started in May 2014, and was commissioned on 17 July 2015.

An environmental permit was obtained in January 2015. The obligations of the permit have been taken into account in operations, and emissions have been in line with the permit regulations. The plant has been implemented using BAT (best available techniques), and tightening environmental requirements have been taken into account in its design.

Comprehensive surveys in 2015
The environmental permit of the paper mill will be audited due to the new Environmental Protection Act and the new BAT conclusions for the pulp and paper industry. The application to audit the permit regulations was submitted in February 2016.

In 2015, several surveys were conducted in relation to auditing the environmental permit. The baseline study of the soil and groundwater in the mill area indicated that the soil and groundwater are uncontaminated in the mill area. The environmental risk survey, covering all operations of the paper mill and its power plant, showed that risks are well under control.

There were challenges in the management of water loads in 2015. The monthly averages of the permit limits set for COD$_{Cr}$ and phosphorus emissions were occasionally exceeded and the annual permit limit set for COD$_{Cr}$ emissions was exceeded. The incident causing the permit limits to be exceeded has subsequently been eliminated and the process to reduce the decontamination load will be continued.

Good development in terms of safety
The improvement of occupational safety has been one of our key goals for years. Our hard work has paid off with our organisation’s accident frequency in 2015 at 3.3 per 1,000,000 working hours, which is the best result in the history of the Kirkniemi mill. The focus of continuous safety improvement is in safety behaviour and in building a lasting safety culture. We will also pay special attention to the safe work practices of our partners working in the mill area.

Kirkniemi, 22 March 2016
Sappi Kirkniemi manufactures high-quality coated publication papers efficiently while respecting the environment. Kirkniemi is part of Sappi Europe. The mill is located by Lake Lohjanjärvi, the largest lake in Southern Finland.

**Products for the print media**

The three paper machines of the Kirkniemi mill produce coated publication paper in a grammage range of 35–100 g/m². Because of its high opacity, the lightest product in the Galerie range, Galerie Lite, is particularly well suited for high-circulation magazines and high-volume catalogues. Galerie Brite is perfect for magazines and catalogues of various types. Galerie Fine is favoured for magazines, customer papers and catalogues.

Bulk qualities of all Kirkniemi Galerie products were launched in 2015. The bulk products offer high opacity, enabling an effective use of paper as customers can use lower basis weights. Nevertheless, the end product is sturdy and feels strong even if the number of pages is low.

The products are sold via the company’s own sales and marketing network. In total, exports make up some 96% of total production.

The properties of Galerie products provide customers with a lighter paper, which results in reduced print production and transportation costs. Galerie products are 100% recyclable. The EU Ecolabel was issued for all Kirkniemi products in 2014.

**Wood is a renewable raw material**

The most important raw material for paper is renewable wood and pulp components manufactured from it: chemical pulp, groundwood pulp and thermomechanical pulp.

Chemical softwood pulp gives the paper its required strength, and mechanical softwood pulp ensures good surface smoothness and premium optical properties. The Kirkniemi mill has certified chain of custody systems in place to verify the origin of wood in accordance with international PEFC™ and FSC® standards.

Other raw materials include
- fillers and coating pigments
- binders and additives
- water

Pigments enhance paper printability. Additives are used to make the papermaking process more efficient and to improve various product properties. Water produces the chemical bonds required between wood fibres in the paper structure.

**Paper Profile**

All paper products manufactured at Sappi Europe mills have environmental Paper Profile product declarations. Paper Profile is a product declaration developed by European paper manufacturers, consisting of information and key figures related to the environmental aspects of paper products in a standardised format. The product declaration offers information about each product’s consistency, production-related emissions and the mill’s environmental system.
**Production process**

The Kirkniemi mill comprises a pulping department and three paper production lines. The pulping department produces the groundwood and thermomechanical pulp (mechanical pulps) required in paper manufacturing. Chemical pulp is mainly acquired from Finnish pulp suppliers.

In the production of mechanical pulp, wood is debarked in a debarking drum. Bark is combusted at the mill's power plant to produce heat and electricity for the mill. Wood fibres are separated from one another using mechanical strain. Through friction, mechanical work is converted into heat, causing the lignin which binds the wood fibres to soften, as a result of which the fibre bonds open. Chemical pulp is bleached using hydrogen peroxide or dithionite. Chemical pulp is slushed in pulpers using water and mechanical strain.

In paper production, various pulps are mixed at specific ratios, and the fillers and additives required are added to form a compound where the water content is higher than 99%. The pulp compound is spread evenly on a water-permeable plastic fabric, i.e. the paper machine wire, where water is removed from the paper web and entered in circulation, assisted by suction. The wet paper web is compressed in the paper machine between felt and rollers, after which the water content of the paper is still higher than 50%.

In the dryer, water is evaporated using steam-heated drying cylinders. The smoke-like mist that can be seen rising out of the paper mill’s chimneys is made up of this vapour. At the drying stage, strong bonds are generated between the paper fibres.

At the coating stage, coating colour is applied to the surface of the paper. It is dried using thermal radiation and hot air, as well as drying cylinders. At the finishing stage, the paper surface is smoothed and glazed using a matt or gloss calender. This is how coated paper gets the desired surface and printing properties. The final moisture content of the paper is about 4%.

In slitting, the parent roll is cut into narrower reels of a smaller diameter. In the packaging department, the reels are protected to endure the entire transportation chain from the mill to the customer’s warehouse.

**Energy and water**

All of the steam and part of the electricity used at the Kirkniemi mill are produced at the mill’s own power plant. A new power plant boiler was commissioned in 2015. It significantly reduces the mill’s energy costs and improves its competitiveness. The paper mill uses some 650 GWh of heat (steam) and slightly less than 1,000 GWh of electricity per year. Steam is used in the paper drying process and in heating process water. Electricity is consumed by various pieces of machinery and equipment. Some of the electricity required is purchased from the national grid.

Paper cannot be manufactured without water. In the paper manufacturing process, wood fibres are separated from one another and formed into a firm uniform web using water. In addition to moving fibres and diluting raw materials, water is also needed for transferring heat, cooling, and washing facilities, machinery and equipment. All effluent from the process is treated at the mill’s effluent treatment plant. Sanitary water is conducted to the municipal purification plant. Purified effluent is discharged into Lake Lohjanjärvi.

Cooling water remains pure and is conducted into the watercourse.
Environmental policy and management system

We are committed to Sappi’s environmental policy and values, and to the commitment to sustainable development. Prosperity, people and the planet constitute the principal factors for sustainable development and the cornerstones of responsible operations. Sappi Kirkniemi’s environmental policy takes these factors and Sappi’s commitment to sustainable development into account in everyday operations.

We implement our environmental policy unconditionally and boldly according to Sappi’s values, making smart decisions and putting them quickly into practice using our systematic, targeted and consistent operational system.

Environmental policy of Sappi Kirkniemi

<table>
<thead>
<tr>
<th>Perspective of environmental impact</th>
<th>Perspective of customers and stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Our objective: Process efficiency and continuous improvement.</td>
<td>• Our objective: Constructive cooperation with stakeholders.</td>
</tr>
<tr>
<td>• Our principle: To develop manufacturing processes and operating methods utilising the best available techniques (BAT), to continuously improve energy efficiency and material efficiency, and to increase recycling.</td>
<td>• Our principle: To discuss and actively communicate our products, manufacturing processes and environmental operations.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Perspective of the personnel</th>
<th>Perspective of the owner</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Our objective: Responsible place to work.</td>
<td>• Our objective: Compliance with laws and sustainable development.</td>
</tr>
<tr>
<td>• Our principle: To set health, safety and the environment as a priority, to provide opportunities for development, and to improve the personnel’s environmental awareness.</td>
<td>• Our principle: To meet regulations and comply with environmental permit limits.</td>
</tr>
</tbody>
</table>

The phases of the execution of the environmental policy in the management system include:

1. Planning
The most important environmental aspects are identified and selected, objectives are set for them, and new indicators are selected for monitoring performance.

2. Implementation
Operating methods for reaching the objectives set are agreed. These are documented in working and operating instructions. The responsibilities of the organisation and different individuals are defined in order to meet the objectives.

3. Audit
Information produced by environmental indicators and the fulfilment of the target values are analysed. The audit serves to identify the areas or functions that need to be developed. In addition, targeted internal audits are also performed.

4. Development
The development measures required (projects, investments, training) are launched, and instructions and operating methods are revised as required. Then, a new round of development is started by reviewing environmental aspects and objectives.
# Environmental aspects

The Kirkniemi mill’s functions have direct and indirect effects on the environment. The impact is minimised by using the best available techniques (BAT) and following sustainable operating methods. Environmental aspects have an impact on the mill’s emissions, raw material and energy consumption and other functions that put strain on the environment.

<table>
<thead>
<tr>
<th>Key environmental aspect</th>
<th>Main environmental impact</th>
<th>Measures to reduce the impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discharges to the watercourse</td>
<td>Local impact south of Lohjanjärvi, eutrophication (phosphorus, nitrogen), oxygen demand (COD\textsubscript{Cr}, BOD)</td>
<td>Compliance with the environmental permit’s emission limits*. Minimising the effluent load at the effluent treatment plant, as reliable and efficient effluent treatment plant operations as possible, secured sufficiency of the effluent treatment plant capacity when planning modifications and investments. Oxidisation of basins in southern parts of Lohjanjärvi.</td>
</tr>
<tr>
<td>Management of incidental releases</td>
<td>Risk of direct environmental impact: emissions to watercourses, air and soil; odour and noise</td>
<td>A functional assessment procedure for environmental risks and an efficient execution of corrective measures when risks are observed: 1) Reduced emissions using technical measures and personnel training. 2) Maintenance and development of combating methods for emissions, an internal rescue plan, own fire department. 3) Efficient information flow. Risks are analysed continuously through the management and reporting procedure for environmental deviations in the SAFA safety data system, annually at all mills using a standardised environmental risk assessment method, and in connection with changes and investments.</td>
</tr>
<tr>
<td>Emissions to air</td>
<td>Soil acidification (NO\textsubscript{2}, SO\textsubscript{2}), air pollution (particles), climate change (CO\textsubscript{2}). Emissions have no significant impact on air quality.</td>
<td>Compliance with the environmental permit’s emission limits*. Emissions trading. Use of renewable fuels. Improved energy efficiency (national energy efficiency agreement).</td>
</tr>
<tr>
<td>Noise</td>
<td>Adverse impact on the immediate surroundings</td>
<td>Compliance with the environmental permit’s emission limits*. Noise suppression for sources of noise as far as is possible. New processes and equipment are acquired so that the mill’s noise level does not increase.</td>
</tr>
<tr>
<td>Efficiency of manufacturing processes – material efficiency</td>
<td>Direct and indirect environmental impact, load on the effluent treatment plant, impact of raw material procurement, impact of waste management</td>
<td>Economical use of raw materials, chemicals and water, and minimised loss. Reduced landfill waste and maximised utilisation of waste and by-products.</td>
</tr>
<tr>
<td>Energy efficiency</td>
<td>Emissions to air, climate change</td>
<td>Energy efficiency agreement, execution and monitoring of energy efficiency measures. Contractual improvement objectives and implementation plan extend to 2016. New goals will be set for 2017 – 2020.</td>
</tr>
<tr>
<td>Transportation</td>
<td>Indirect environmental impact (emissions to air, noise, energy consumption)</td>
<td>Sappi Europe’s central administration is responsible for transportation. Kirkniemi reduces the environmental impact caused by internal and local transportation through thorough planning of transportation.</td>
</tr>
<tr>
<td>Use of wood raw material</td>
<td>Local environmental impact (biodiversity, land use)</td>
<td>Metsäliitto, which is responsible for wood procurement for the Kirkniemi mill, pulp manufacturers and the Kirkniemi mill have certificates of the chain of custody (PEFC™ CoC ja FSC® CoC). As a result, we know the origins of wood and the share of certified wood. In this way, we can ensure that the wood used in pulp originates from sustainable forests. The share of certified wood from the fibre used in Kirkniemi products is more than 80%.</td>
</tr>
</tbody>
</table>

* The environmental permits of the Kirkniemi paper mill and power plant define threshold values for the effluent discharges, emissions to air and noise. Compliance with these values prevents significant environmental impact from being generated.
Sappi Kirkniemi and BAT (best available techniques)

BAT has become a key indicator in the forest industry. Sappi Kirkniemi has invested in environmental protection in order to reach the BAT level.

According to the Environmental Protection Act, regulations set out in environmental permits must be based on the best available techniques (BAT). BAT consists of a group of case-specific measures, technical solutions and emission level targets that help in achieving a good level of environmental protection. The EU has prepared a BAT reference document for the pulp and paper industry (BREF), which contains information on suitable techniques and a range of guideline values (e.g. for effluent discharges).

In 2015, a comprehensive survey of the compliance of mill operations with BAT was conducted at the Kirkniemi mill. In addition to BAT reference documents for the pulp and paper industry, the survey covered secondary BAT reference documents for operations concerning energy efficiency, storage-induced emissions, industrial cooling systems and general monitoring principles.

BAT requirements demand, for example, that the mill has a consistent, systematic and goal-oriented management system which takes environmental issues into account. The Kirkniemi mill’s ISO 14001 certified environmental system meets these requirements. General technical solutions following BAT include the Kirkniemi mill’s efficient and highly automated process control system, as well as the mill’s systematic and preventive equipment maintenance. Risk management, the handling and storage of chemicals and raw materials, and waste management fulfil the BAT requirements. The ISO 50001 energy management system verifies commitment to the continuous improvement of energy efficiency and to the extensive application of best available techniques as described in BAT reference documents.

In addition, field-specific BATs include dry debarking of wood, a water system which enables the efficient use and recycling of process water, effective pulp washing of mechanical pulp, separate treatment of pigment-containing effluents, and biological effluent treatment, all of which are in use.
Eco-efficiency is part of everyday work

Companies may easily think that sustainable development only concerns management and that individual employees cannot have any influence on it. However, this is not the case. Sustainable activities start with each and every one of us.

Sappi Europe launched an eco-efficiency programme for the entire personnel in 2015. The backbone of eco-efficiency is “Yes, I care.” This slogan indicates that eco-efficiency starts from every Sappi employee, regardless of their position. Everyone needs to act sustainably and commit to the company’s sustainability objectives. Everyone has something to give, be it waste sorting, process development or minimised loss.

The objective of eco-efficiency is to manufacture products with as low energy and material volumes as possible. When raw and other materials, energy and technology are used as effectively and purposefully as possible, there will also be less waste and fewer emissions, as well as lower production costs.

Instead of theory, Sappi’s eco-efficiency programme emphasises the practice, in which everyone plays an important part. Sharing the best stories with everyone forms an essential part of the programme. Eco-efficiency stories are available on the Sappi website at www.sappi.com.

Sappi. Eco. Effective.

Yes, I care.

Because water is one of the essential ingredients in the paper making process. It is recycled several times within various mill processes in order to minimize the consumption of fresh water. Rigorously enforced environmental standards ensure that the wastewater is always fully treated before leaving the mill.

As part of my job, I am constantly looking for ways to improve the way water is used within the Kirkniemi mill. One of the challenges is to balance water usage and resulting waste water flow to ensure even operating conditions at the effluent treatment plant.

By taking the time to analyse the situation, we have designed a clever piece of software that can calculate and communicate the water balance status within the mill at any given time. The tool has been very effective and is used in every production department to support waste water flow management, further improving the performance of the effluent plant.

I make Sappi eco-effective. How about you?

Timo Mäkelä, Development Engineer, Kirkniemi Mill. sappi.com/eco-effective
Use and treatment of water

Paper cannot be manufactured without water. Water is used effectively by circulating it in the manufacturing process according to the counterflow principle.

In addition to moving fibres and diluting raw materials, water is also needed for transferring heat, cooling, and washing facilities, machinery and equipment. Water is circulated in the manufacturing process according to the counterflow principle and fresh water is only used where it is absolutely necessary.

The volume of process water used at the mill is low, i.e. 9–10 m³/t. Water is taken for the mill from Lake Lohjanjärvi, and water procurement does not compete with the intake of drinkable water.

**Process waters treated according to BAT**

The mill’s process effluent is treated using internal and external purification methods. Internal purification uses ultra-filter equipment and efficient disc filters for purifying paper machine white water and recovering fibres. For external purification of effluent, Kirkniemi has an effective effluent treatment plant which consists of mechanical, biological and chemical treatment steps. Normally, some 17,000 m³ of effluent is conducted to the effluent treatment plant every day. Any deviating effluent can be conducted to the effluent treatment plant through a secondary basin. Purified water is discharged into Lake Lohjanjärvi.

Cooling and sealing waters pass in separate systems, and they are returned to watercourses as pure water fractions.

Process water handling and effluent treatment at the Kirkniemi mill are in accordance with the BAT set by the EU for the pulp and paper industry. The mill’s use of water and the effluent load are in line with BAT levels, apart from solids contained in effluents, the level of which exceeds the threshold value set out in the BAT reference document. The content of solids in effluents increases in the chemical mixing phase at the effluent treatment plant when the removal of phosphorus, the substance which consumes oxygen from effluents, and nitrogen is boosted to ensure that levels are below the tight environmental permit limits. This is referred to as a cross-effect.
Loads on watercourses and fulfilment of permit conditions

The Sappi Kirkniemi paper mill and power plant have legally valid environmental permits, the provisions of which have been taken into account in mill operations. Furthermore, the mill and power plant have a valid water intake permit regarding Lake Lohjanjärvi.

According to the survey conducted in 2015, nearly 90% of the organic loads conducted to the effluent treatment plant originate from the debarking plant and pulp manufacture where high volumes of organic matter and nutrients contained in wood dissolve into water. Furthermore, the bleaching degree of mechanical pulp has an impact on loads of organic matter. The share of the mill’s PGW pulp with a high brightness degree from mechanical pulp has increased in recent years.

In 2015, loads of solids at the treatment plant increased for two months, which had an impact on the increase in COD$_{cr}$ loads. What is more, the increase in solids caused difficulties in treatment plant processes. The loads of solids originated from the PGW process in the pulp department. To fix the situation, the effluent running pattern was changed in the pulp department, after which the loads of solids returned to the normal level and the COD$_{cr}$ reduction increased at the treatment plant.

For the aforementioned reasons, the monthly COD$_{cr}$ average of 6,000 kg/d set out for effluent emissions in environmental permit regulations was exceeded during two months in 2015. As a result, the annual average of 4,500 kg/d set out in environmental permit regulations was exceeded, with annual emissions being 4,841 kg/d. With regard to phosphorus, the monthly average of 9 kg/d set out in environmental permit regulations was also exceeded during two months in 2015. This situation was reported to the supervisory authority and the town of Lohja, and notifications of deviations in permit limits were submitted.

Kirkniemi has initiated actions to reduce the loads conducted from the paper mill to the treatment plant: internal sources of emissions have been identified at the mill and technical solutions are being examined. In addition, the mill is taking part in a research project funded by Tekes (Novel concepts for recalcitrant COD reduction), the aim of which is to develop new concepts for the removal of recalcitrant COD and the minimisation of emissions. The two-year project will start in April 2016.

<table>
<thead>
<tr>
<th>Emission parameter</th>
<th>Unit</th>
<th>Permit limit, monthly average</th>
<th>Permit limit, annual average</th>
<th>Realised annual average in 2015</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD$_{cr}$</td>
<td>kg/d</td>
<td>6,000</td>
<td>4,500</td>
<td>4,841</td>
<td>The annual permit limit was exceeded, the monthly limit was exceeded twice</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>kg/d</td>
<td>9</td>
<td>7</td>
<td>4,9</td>
<td>The monthly limit was exceeded twice</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>kg/d</td>
<td>130</td>
<td>100</td>
<td>52</td>
<td>No excess</td>
</tr>
</tbody>
</table>

The 2015 annual reports have been entered to the Environmental Administration’s database according to the permit conditions, and the specific authority has approved the reported information.
Sappi Kirkniemi effluent emissions (2015) compared with the BAT level

<table>
<thead>
<tr>
<th>Parameter</th>
<th>BAT emission level Integrated manufacture of mechanical pulp and paper</th>
<th>Status Kirkniemi mill 2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>COD$_{cr}$</td>
<td>0.9–4.5</td>
<td>2.8</td>
</tr>
<tr>
<td>Solids</td>
<td>0.06–0.45</td>
<td>0.76</td>
</tr>
<tr>
<td>Total nitrogen</td>
<td>0.03–0.1</td>
<td>0.03</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>0.001–0.01</td>
<td>0.003</td>
</tr>
<tr>
<td>Purified effluent into the watercourse</td>
<td>9–16</td>
<td>9.2</td>
</tr>
</tbody>
</table>
Impact on watercourses

The state of Lake Lohjanjärvi has improved and the mill’s watercourse loads have reduced over the past decades, even though production has increased at the same time.

Lake Lohjanjärvi is the largest lake and the most significant watercourse in terms of recreational value in the Uusimaa region. Lake Lohjanjärvi has a highly fragmented morphology and there are also differences in water quality between different areas.

In a classification compatible to the EU Water Framework Directive, the southern part of Lake Lohjanjärvi has been defined to be high in nutrients and lime, and the ecological category of its water is satisfactory. The ecological category was mainly reduced by the poor oxygen conditions in the hypolimnion and evaluations of the condition of bottom fauna.

Sappi Kirkniemi’s purified effluent is discharged to Osunienmenlahti located in the southern part of Lohjanjärvi. The discharge of effluent causes local environmental impact which is only detectable in the immediate vicinity of the discharge area. Overall, the mill has a very limited impact on the water quality in the lake. The Kirkniemi paper mill is the most significant source point of pollution in Lake Lohjanjärvi in terms of phosphorus and solids. According to the most recent balance calculations, the Kirkniemi mill has accounted approximately 10% of total phosphorus loads in the southern part of Lake Lohjanjärvi and approximately 4% of nitrogen loads. The majority of the total nutrient loads in Lake Lohjanjärvi, approximately 85%, consist of diffuse loads.

The mill only accounts for approximately 7% of the total load of solids in Lake Lohjanjärvi.

The environmental load caused by the Kirkniemi mill has reduced clearly over the years, which can best be seen as the improvement in the

Ecological category of surface water or another evaluation of the state

- Excellent
- Good
- Satisfactory
- Adequate
- Poor
quality of water in the discharge area.

From Lohjanjärvi, water is discharged into the Baltic Sea in Pohjanpitäjänlahti via Mustionjoki. The mill’s loads do not cause any significant impact on Mustionjoki or Pohjanpitäjänlahti. Mustionjoki has a clearly higher water quality than Nummenjoki and Väänteenjoki, two rivers that cause loads in the lake.

In addition to purified effluent, uncontaminated cooling water (30,000–95,000 m³ per day) is discharged from the mill to Lake Lohjanjärvi. The cooling waters and effluents cause a slight increase in water temperature near the discharge points. The temperature increase weakens the ice in the discharge areas in the wintertime.

Internal load in the water system

As time has passed, a large amount of nutrients has accumulated in the bottom sediment, through natural processes and because of the loading caused by human activity. Disintegrating organic matter consumes the oxygen resources of the bottom layer (hypolimnion), which may result in nutrient release into the water.

The worse the oxygen situation of the bottom layer is the more phosphorus is released. From the bottom layer, the nutrients travel to the surface layer (epilimnion) as the water layers blend with each other, where they will again be available for basic producers, such as algae. This results in eutrophication and increasingly rapid internal loading (Picture 1). The oxygen state has a significant impact on bottom fauna, which has been found to be a notable indicator when assessing the ecological category of Lake Lohjanjärvi.

Oxygenation pumping of deeper sections helps to restore the biological condition of the lake

Warm water does not bind oxygen and internal loading consumes oxygen. To improve water quality in Lake Lohjanjärvi, the Kirkniemi mill has been oxygenating the deeper parts of the lake since 1986 (Picture 2). There are four Mixox oxygenation pumps in the lake deeps.

In autumn 2011, the oxygenation capacity was raised and the monitoring of the oxygenation pumps was increased to improve operational reliability. The reliability of oxygenation pumps located in the lake deeps in Kyrkofjärden was further improved in 2014 by replacing cables and remote control equipment.

The oxygenation of the lake deeps has improved the state of bottom areas. The impact of oxygenation can clearly be seen as phosphorus content is lower near the bottom. In the 2000s, only individual peaks in the phosphorus content have been measured. Overall, the oxygen situation has improved slightly after the oxygenation capacity was increased in 2011.

The restoration of Osuniemenlahti bay in 2003 significantly reduced the suspended organic matter from the bottom sediments in the bay. However, the restoration has not had any significant impact on water quality in the southern part of Lake Lohjanjärvi. Furthermore, the impact has been local.

The Kirkniemi mill participates in the annual joint monitoring project for point sources in Lohjanjärvi organised by Länsi-Uusimaa vesi ja ympäristö ry (Western Uusimaa water and environment association) for monitoring water quality and development.

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**Eutrophication and generation of oxygen depletion**

- External phosphorus load from the upper catchment area
- Algae growth
- Oxygen-consuming organic matter in discharged water
- Oxygen-consuming matter
- Phosphorus release
- Sediment which remains in poor condition due to oxygen depletion
- Load history of bottom sediment: residential and other effluent, algae growth

**Restoring and prevention of oxygen depletion**

- External phosphorus load from the upper catchment area
- Algae growth
- Oxygen-consuming organic matter in discharged water
- Oxygen-consuming matter
- Phosphorus release
- New (improved) sediment. The poor period remains under the new sediment
- Load history of bottom sediment: residential and other effluent, algae growth

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Picture 1. Vicious circle of lake eutrophication.

Picture 2. Oxygenation of the deeper sections helps to restore the biological condition of the lake.
Use of energy and continuous improvement of energy efficiency

The objective of the Kirkniemi mill is to manufacture products by using energy as efficiently as possible. In 2009, the mill joined the national energy efficiency agreement. The ISO 50001 certificate was granted in 2012.

The pulp and paper industry consumes loads of energy in its functions. At the same time, however, the forest industry is clearly the largest producer of bioenergy in Finland.

Energy from the mill’s power plant
At Kirkniemi mill, energy is produced from biofuels, coal and natural gas at the mill’s own power plant. The mill’s power plant produces process steam used at the paper mill and some of the electricity used at the mill. Some of the electricity is still purchased from the national grid.

The most recent power plant boiler was started in summer 2015. It is a modern circulating fluidised bed boiler which can effectively burn different biofuels and coal. The high pressure and temperature of the boiler enables the efficient production of energy and, thanks to its modern combustion and purification technology, its specific emissions are low. In addition to the new multi-fuel boiler, the K2 boiler which burns biofuels is also in continuous production use. The share of biofuel was 25% at the power plant in 2015.

Energy circulates through paper mill processes
At the paper mill, process steam produced at the mill’s power plant is mainly used in drying the wet paper web. Small volumes of natural gas are also used in coating machines for drying the coating layer. A significant part of the steam used in drying is recycled through the mill’s heat recovery units and is used in other applications, such as in heating process waters and paper machine facilities.

The use of electricity at the Kirkniemi mill is divided fairly evenly between pulp manufacturing and paper manufacturing. Nearly 100% of the electricity used in drying is converted into thermal energy and some of it is bound to the mill’s process water. Some energy can be recovered as steam, which can be used directly at the paper mill. As a result, the same energy circulates several times through different mill processes and produces the best possible benefits.

Continuous improvement of energy efficiency as an operational focus point
At the end of 2009, the Sappi Kirkniemi mill joined the national energy efficiency agreement, and it uses the ISO 50001 energy efficiency system which ensures continuous improvement. Before joining the agreement, energy efficiency played an important part in developing mill operations. The Kirkniemi mill’s energy efficiency goal is to reduce its total energy consumption by 7% by 2016. The savings objectives extending to 2016 were already exceeded in 2014. New goals will be set for 2017–2020.

At the Kirkniemi mill, energy efficiency is improved through personnel training, energy efficiency investments, energy efficient operating methods, continuous consumption monitoring and systematic energy analyses. Energy consumption is continuously monitored through specific energy consumption, meaning the energy required in the manufacture of each paper ton produced (MWh/t). In 2015, the manufacture of each paper ton required an average of 1.3 MWh/t of electricity and 0.99 MWh/t of steam at the Kirkniemi mill.

The most significant investments in 2013–2015 aimed at improving energy efficiency included the optimisation of the energy efficiency of the PGW process in pulp manufacture and grinding wheels in the main PGW line, the optimisation of reject beating and the implementation of heat recovery from reject treatment processes.
Emissions to air and impact on air quality

The majority of the emissions to air from the paper mill are caused by energy production. The smoke rising from the paper mill consists of water vapour that returns to the ground through rainfall becoming a growth factor in forests.

Paper and pulp manufacturing causes only minor direct emissions to air that do not have any impact on air quality in the immediate surroundings. The paper mill produces small volumes of carbon dioxide and nitrogen oxides through the combustion of natural gas in paper drying. In addition, some wood-based organic compounds evaporate in pulp manufacturing. These can mainly be identified in the mill area as a recognisable wood odour.

**New power plant boiler started in 2015**

An environmental permit was obtained for the operations of the new power plant boiler in January 2015 and a decision on the adjustment of specific permit regulations on the existing power plant was obtained in August 2015. The permit regulations have been taken into account in power plant operations. Limits have been set for the power plant’s air emissions in its environmental permits. In 2015, the emissions were in compliance with the permits.

Considering nitrogen oxide emissions, the Kirkniemi power plant is the largest single load in Lohja. Sulphur dioxide emissions increased in 2015 due to the start-up of the new multi-fuel boiler. Natural gas, the previous main fuel, does not contain any sulphur.

**Minimised emissions to air**

To minimise the air emissions caused by the mill and power plant, we monitor the efficiency of combustion processes, use emission reduction techniques in accordance with the BAT reference document for energy production and maintain the operating condition of purification equipment. Improved energy efficiency reduces the need for energy and, therefore, the emissions from energy production.

**Minor impact of energy production on air quality**

Emissions from energy production are released through tall chimneys and are diluted efficiently, meaning that energy production causes fairly minor impact on the local quality of air. According to the flue gas spreading model prepared in conjunction with the environmental permit process for the new boiler, increasing sulphur dioxide or particulate emissions do not have any significant impact on air quality in the area. Actual values were clearly below the guideline and threshold values set for air quality. The most significant factors affecting the quality of air in the Lohja region include traffic and local combustion of wood. They have a major impact on the quality of air because they release emissions at a low level.

The Kirkniemi mill and power plant are within the scope of the EU emissions trading, and the relevant permits are in force. Emission declarations have been verified, and CO₂ emissions pursuant to the Emissions Trading Act have been transferred. The power plant’s carbon dioxide emissions contribute to global warming but do not have any significant impact on the local air quality.
Emissions to air from the Kirkniemi mill and power plant in 2015

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Unit</th>
<th>Paper mill</th>
<th>Power plant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particles (PM)</td>
<td>t/a</td>
<td>0</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Nitrogen oxide (NO&lt;sub&gt;x&lt;/sub&gt;)</td>
<td>t/a</td>
<td>9.1</td>
<td>284.5</td>
<td>293.6</td>
</tr>
<tr>
<td>Sulphur dioxide (SO&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>t/a</td>
<td>0</td>
<td>99.2</td>
<td>99.2</td>
</tr>
<tr>
<td>Carbon dioxide, fossil (CO&lt;sub&gt;2&lt;/sub&gt;)</td>
<td>t/a</td>
<td>20,903</td>
<td>202,532</td>
<td>223,435</td>
</tr>
</tbody>
</table>
Noise

The Kirkniemi mill causes noise of a varying level and quality in its environment. Limits for ambient noise have been set out in the environmental permits of the mill and power plant. The level and sources of noise are monitored regularly through ambient noise measurements and, if required, through noise modelling. The most recent noise survey was conducted in 2015.

Most of the noise can be characterised as a steady low-frequency humming sound. In addition, there is various disturbing noise caused by wood processing, conveyors, vehicles and alarms.

The ambient noise levels caused by the mill have not changed in recent years. The start-up of the new power plant boiler did not change the noise spreading zones. No excess of threshold values set out in the environmental permits have been identified in ambient noise measurements or modelling when taking into account the uncertainties associated with the methods. However, various weather conditions have a significant impact on the spreading of noise.

Our aim is to avoid causing unnecessary noise in our operations. The noise sources located in the mill area, such as air conditioning fans for process ventilation, air intake grilles, heat recovery equipment and effluent treatment compressors, are equipped with silencers where possible.

Noise levels are taken into account when new processes or equipment are adopted so that the mill’s ambient noise level does not increase.
Odour

The manufacture of pulp and paper does not discharge any odorous sulphur compounds (TRS) into the air. Fans in the pulp department discharge low volumes of volatile organic compounds (VOC) appearing naturally in wood. Small volumes of compounds are also discharged from the wood field, wood chip stock and effluent treatment plant.

In oxygen-free conditions, effluent generates TRS compounds, the content of which may occasionally exceed the odour threshold. Odours may be generated at the effluent treatment plant, mainly in preliminary settling, the secondary basin and biosludge drying. The raw materials and chemicals used in paper manufacturing may have an impact on the odour generation potential existing in effluent.

The aim is to reduce the generation of odours by optimising production and effluent treatment plant processes, reducing the use of chemicals which may cause odour nuisances, and planning any odour-generating activities thoroughly and distributing information about them in advance.

To prevent the generation of any odour nuisances, the secondary basin and preliminary settling are kept as empty of sludge as possible. The odours caused by the storage of biosludge have decreased after the adoption of the thermal biosludge drier in 2012. Odour emission gases generated during the drying process are combusted in the power plant boiler, and the handling of biosludge does not normally generate any odour nuisances in the surroundings of the mill. After a change in practices, biosludge is only stored during the maintenance of the drier or power plant boilers.

Clearly fewer odour nuisances have been generated in the past few years. According to the odour survey conducted in 2010, experienced odour nuisances had decreased from the 2004 situation. Neighbours have been notified of any odour nuisances generated through secondary basin dredging at the treatment plant and the transportation of sludge on three occasions in 2013–2015.
Material efficiency and increasing utilisation

We utilise natural resources efficiently and sparingly, minimise the environmental impact caused by our production, and recycle efficiently. Our production processes have been developed so that we can manufacture more end products with fewer raw materials.

Process efficiency enables us to reduce direct environmental impact and minimises the indirect environmental impact caused by the procurement of raw materials and energy production.

Our aim in raw material efficiency is to have as low a solid matter loss as possible at the effluent treatment plant. We have carried out a number of projects in recent years that have improved the recovery rate of fibre and pigments. The loss of solid matter has lowered to 1.5%. Where possible, we replace hazardous chemicals with less hazardous ones.

Effective sorting secures the fulfilment of utilisation objectives

The aim is to primarily utilise all waste and minimise the volume of landfill waste. The waste utilisation rate is very high (more than 99%). Some 55,000 tons of waste suitable for utilisation is generated annually. Of this number, 90% is made up of large waste fractions, i.e. power plant ash, effluent treatment sludge and wood bark, which are utilised in full.

The mill’s environmental permit prescribes waste-related regulations with regard to sorting, waste accounting and the management of hazardous waste. After the change in the mill’s waste management in 2011 and 2012, the efficiency of waste management has been continuously improved. The paper mill contains a comprehensive sorting system where paper, cardboard, metal, wood, energy fractions, biowaste, landfill waste and hazardous waste are collected separately. Through the upgraded waste management, the volume of waste carried to landfill sites has been reduced by half from the previous level.

Waste is delivered to operators with environmental permits for proper utilisation or disposal. The Finnish Food Safety Authority Evira has approved that fibre sludge from the effluent treatment plant can be used as a soil conditioner.

Applications where large waste fractions can be utilised

<table>
<thead>
<tr>
<th>Waste fraction</th>
<th>Utilisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood bark from the debarking plant</td>
<td>Fuel at the mill’s power plant</td>
</tr>
<tr>
<td>Fibre sludge from the effluent treatment plant</td>
<td>Fuel at the mill’s power plant</td>
</tr>
<tr>
<td></td>
<td>Land construction material in surface</td>
</tr>
<tr>
<td></td>
<td>structures at landfill sites</td>
</tr>
<tr>
<td></td>
<td>Manufacture of soil conditioners</td>
</tr>
<tr>
<td></td>
<td>Soil conditioner</td>
</tr>
<tr>
<td>Biosludge from the effluent treatment plant</td>
<td>Fuel at the mill’s power plant after</td>
</tr>
<tr>
<td></td>
<td>thermal drying</td>
</tr>
<tr>
<td></td>
<td>Manufacture of soil conditioners</td>
</tr>
<tr>
<td>Ash from the power plant</td>
<td>Land construction material</td>
</tr>
<tr>
<td></td>
<td>Utilisation in waste handling</td>
</tr>
</tbody>
</table>
Utilisation of waste in 2015:

- Energy utilisation 63.6 %
- Material utilisation 36.2 %
- Landfill disposal and other disposal activities 0.2 %

Solid matter loss at the effluent treatment plant

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**Yes, I care.**

Because I’ve always been aware of the environmental impact of my actions. I work at the coating colour kitchen at the Kirkniemi Mill and noticed that small amounts of unused coating colour remained in the tank during the stand-stills, simply because the suction pipes didn’t reach the bottom of the tank. A minor investment made to adjust the pipes resulted not only in overall cost savings, but a huge reduction in wasted coating colour, equivalent to 42 tonnes per annum, discharged to the effluent treatment plant.

I make Sappi eco-effective. How about you?

_Aino Leiviskä, Coating Colour Preparation Operator, Kirkniemi Mill._

[sappi.com/eco-effective](http://sappi.com/eco-effective)

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Sappi. Eco. Effective.
Management of environmental risks is a significant part of environmental protection

The objective of the management of environmental risks is to secure production and see to the environment so as to maintain it in a safe and healthy condition. Risk management and the prevention of incidents forms a significant part of the environmental protection.

The management of environmental risks associated with industrial production largely comprises the management of emissions where the management of unplanned emissions is particularly emphasised. Risk management and actions during incidents comprise parts of the mill’s certified management systems, i.e. ISO 9001 and ISO 14001.

The manufacture of mechanical pulp and paper is generally a safe and stable process. As a consequence of incidents or accidents in manufacturing processes, emission purification equipment, the storage and use of chemicals or elsewhere in the mill area, operations may cause emissions to water, soil or air deviating in terms of their quantity or quality.

Impact on the environment can be minimised by preparing for incidents

Various accidental situations have been prepared for using structural and technical solutions, protective fences, automated alarm systems, monitoring practices, maintenance activities and operating instructions. Processes are supervised around the day, and monitoring and information flow during irregular situations have been arranged so that any incidents can be identified and the required action can be taken before any significant environmental damage can occur. The personnel have been trained to observe any environmental risks and to act properly in irregular situations. Furthermore, safe working methods and proper activities in case of irregular situations are trained to partners working at the mill and transporters of chemicals and raw materials. The mill has its own fire brigade which has the required training and equipment to combat chemical and oil spills.

Safe handling of chemicals is the key

Occupational safety and environmental risks are usually interconnected. For example, the correct handling and storage of chemicals improves occupational safety and reduces the possibility of environmental risks. The mill is classified to handle and store chemicals on a large scale. The mill has a permit issued by the Finnish Safety and Chemicals Agency (Tukes), the operating principle document required by the scope of activities and an internal rescue plan for the storage and handling of chemicals.

Sulphur dioxide is the only
chemical used at the mill which poses the risk of a major accident. The use of chlorine in disinfecting raw water was discontinued in 2012.

A public announcement has been prepared for the risk of major accidents. It is available on the Sappi website at www.sappi.com.

Preventive risk evaluations in many ways

The Kirkniemi mill places stress on preventive evaluations of work-related risks in order to prevent any hazards through the means of early observations. Work safety evaluations are conducted regularly, reviewing not only occupational safety aspects, but also environmental risks. Any environmental non-conformities occurred at the mill are reported in the safety information system which is available to the entire personnel. The causes of non-conformities are identified and actions to reduce corresponding risks are defined.

Environmental risks are evaluated annually using the risk evaluation method applied at all Sappi mills. In conjunction with major investments or process modifications, any environmental risks associated with the changes are also evaluated.

In the chemicals approval procedure, the impact caused by new chemicals to be used on environmental risks is also evaluated.

An extensive environmental risk evaluation covering all mill and power plant functions was conducted at the mill in 2015. No significant environmental risks requiring immediate measures were identified in the evaluation. Nearly all risk factors that can be eliminated using technical means have been removed. The majority of the identified risks are associated with the possibility of a human error and control measures are related to the maintenance and development of the personnel’s expertise. The results of the risk evaluation have been reviewed and the control measures required have been defined. The measures have been completed or are in progress.

Positive development in terms of risk management

No sudden incidental releases causing a hazard to the environment have occurred at the mill since 2008. The importance of internal non-conformity reporting has been emphasised in recent years and the number of reports has clearly increased. By reporting and handling even the smallest non-conformities, the personnel’s awareness of the environment and risks increases and the efficiency of risk management improves.

The state of the soil and groundwater in the mill area has been identified

In 2015, a baseline study of the soil and groundwater in the mill area was conducted. The purpose of the baseline study was to define the state of the soil and groundwater in the mill area so that it can be compared to the situation when operations are finally discontinued. During the study, substances used at the mill posing the risk of contamination in the soil and groundwater, the operating history, environmental conditions and the chemical state of the soil and groundwater were identified. As a result of the study, it was defined that the soil and groundwater are not contaminated.
Safety work pays off

The long-term development of occupational safety has paid off. The accident frequency at Sappi Kirkniemi had been reduced by 90% from the level at the end of the previous decade.

At the end of 2015, the mill was close to its objective of zero accidents as the accident frequency lowered to 3.3 accidents per one million working hours. Work was performed at Kirkniemi for 299 days and more than 700,000 working hours without any accidents.

The aim is to reach the objective of zero accidents by eliminating any risky behaviour and by continuously improving working conditions and methods. The identification of hazards and the evaluation and management of risks are continuous activities that are based on the monitoring and analysis of working conditions and methods and the machinery and equipment used at work.

Increasing the visibility of safety

Particular focus points in 2015 were the improved awareness of safety and the increased visibility of safety. Safety awareness was maintained through the continuous review of hazards occurred and observations made, monthly safety sessions organised by supervisors and various campaigns. At the end of the year, a project was launched to secure the safety of partners, in which the safety aspects included in the delivery processes of partners producing technical services and any development needs therein are reviewed.

In June, it was the turn of Sappi’s annual and global safety week, the objective of which is to have the entire personnel and all partners focus on the importance of safety. At various events, different mill departments and partners presented their safety activities and external experts gave lectures of wellbeing at work.

Let us take a moment to think!!

Our positive development has been supported by the adoption of the booklet to evaluate hazards when starting work in 2014. The use of the booklet forces us to stop for a moment each day in order to think of any hazards and risks present in our work. The department- and team-specific workplace rounds performed by managers and the safety evaluations conducted by supervisors and experts serve to pay attention to operating methods and safety behaviour. These improve the personnel’s awareness of risks and strengthen attitudes towards safety.

In 2016, the focus of continuous safety improvement will be in safety behaviour and in building a lasting safety culture. The safety programme to start at Sappi Kirkniemi is in a key position. The programme and the overall objective are supported by active and preventive safety observations, in relation to which we have a full-year hazard observation campaign in progress. Our objective is that more than 90% of the personnel make at least two hazard observations.

Furthermore, our objective is to continue towards our goal of zero accidents so that everyone working at Sappi Kirkniemi are able to return home safely and in good condition.
Material balance

The material balance gives an overall picture of the use of resources, the products manufactured and emissions generated in 2015.

### Input

<table>
<thead>
<tr>
<th>Energy</th>
<th>Fuel (GWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural gas to energy production</td>
<td>405</td>
</tr>
<tr>
<td>Natural gas to the coating process</td>
<td>90</td>
</tr>
<tr>
<td>Coal</td>
<td>345</td>
</tr>
<tr>
<td>Biofuels (bark, sludge, wood)</td>
<td>256</td>
</tr>
<tr>
<td>Share of biofuel 25.5%</td>
<td></td>
</tr>
</tbody>
</table>

**Energy consumption in production**

<table>
<thead>
<tr>
<th>Electricity</th>
<th>837 GWh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity specific</td>
<td>1.34 MWh/t</td>
</tr>
<tr>
<td>Heat</td>
<td>622 GWh</td>
</tr>
<tr>
<td>Heat specific</td>
<td>0.99 MWh/t</td>
</tr>
</tbody>
</table>

**Heating of buildings**

<table>
<thead>
<tr>
<th>41 GWh</th>
</tr>
</thead>
</table>

**Fuels for industrial vehicles**

| Diesel | 2.8 GWh |
|        |        |
| Liquid natural gas | 0.06 GWh |

**Raw materials and auxiliary chemicals**

- **Total wood supply (m3)**
  - Round wood 608,400
  - Wood chips 0
  - Use of wood specific 0.97 m3/t

- **Total pulp (t, dry)**
  - Mechanical pulp produced 200,000
  - Purchased chemical pulp 128,000
  - Total pulp specific 546 kg/t

- **Other chemicals (t, dry)**
  - Pigments and fillers 250,000
  - Binders 25,000
  - Additives 12,000
  - Total chemicals specific 477 kg/t

**Fresh water intake (1,000 m3)**

- Raw water intake from the lake 23,550
- Intake for cooling and sealing 17,600
- Cooling and sealing water specific 28.1 m3/t
- Intake as process water 6,050
- Process water specific 9.7 m3/t
- Intake as process water for the power plant 380

**Size of the mill area**

<table>
<thead>
<tr>
<th>112 ha</th>
</tr>
</thead>
</table>

**Personnel**

<table>
<thead>
<tr>
<th>543</th>
</tr>
</thead>
</table>

### Output

**Emissions into the air**

- **Mill and power plant**
  - Sulphur dioxide SO₂: 99 t
  - SO₂ specific: 0.16 kg/t
  - Nitrogen oxides NOₓ: 294 t
  - NO₂ specific: 0.47 kg/t
  - Particles: 2.1 t
  - Particles specific: 0.003 kg/t
  - Fossil carbon dioxide: 223,400 t
  - CO₂ fossil specific: 357 kg/t
  - CO₂ biogenic: 101,200 t

- **Industrial vehicles**
  - SO₂: 0.005 t
  - NO₂: 7.3 t
  - Particles: 0.60 t
  - CO₂ fossil: 792 t

- **Paper production**
  - 625,200 t
  - Share of PEFC™ certified fibre: 88%

- **Waste materials (dry)**
  - Total waste: 54,820 t
  - Total waste specific: 87 kg/t
  - Waste utilisation rate: 99.8%
  - Bark and sludge combusted: 34,400 t
  - Share of recyclable waste: 63%
  - Ash: 15,100 t
  - Ash specific: 24.1 kg/t
  - Total landfill waste: 94 t
  - Landfill waste specific: 0.15 kg/t
  - Amount of trash in landfill waste: 74 t
  - Hazardous waste: 50 t
  - Hazardous waste specific: 0.08 kg/t

- **Discharges to watercourse**
  - Effluent flow: 5,762,000 m³
  - Effluent flow specific: 9.2 m³/t
  - Chemical oxygen demand (COD): 1,767 t
  - COD specific: 2.83 kg/t
  - Biological oxygen demand (BOD): 103 t
  - BOD₇ specific: 0.16 kg/t
  - Phosphorus (P): 1.79 t
  - P specific: 2.9 g/t
  - Nitrogen (N): 19.1 t
  - N specific: 31 g/t
  - Total solid matter: 478 t
  - Solids specific: 0.76 kg/t

27 Emas statement 2015–2017
## Fulfilment of environmental goals in 2015

<table>
<thead>
<tr>
<th>Target</th>
<th>Key figure and target value</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient waste sorting and utilisation</td>
<td>• Utilisation rate &gt; 99%&lt;br&gt;• Bark and sludge combusted &gt; 75%&lt;br&gt;• Landfill waste after sorting &lt; 100 t/a</td>
<td>99.8%&lt;br&gt;63%&lt;br&gt;74 t/a</td>
</tr>
<tr>
<td>Good management of environmental risks: Identification of risks, analysis of non-conformity, and preventive measures</td>
<td>• Internally reported environmental non-conformities in the SARA system&lt;br&gt;• 0 unexplained non-conformities causing disturbance at the treatment plant&lt;br&gt;• 0 incidental releases</td>
<td>Ready&lt;br&gt;0 pcs&lt;br&gt;0 pcs</td>
</tr>
<tr>
<td>No severe incidental releases</td>
<td>• Solid material loss in wastewater &lt; 16 kg/t&lt;br&gt;• Daily excess of effluent flow 210 l/s, monitoring</td>
<td>15 kg/t&lt;br&gt;46 pcs</td>
</tr>
<tr>
<td>Improvement of raw material efficiency and water management</td>
<td>• Effluent flow &lt; 10 m³/t&lt;br&gt;• BOD₅ &lt; 0.23 kg/t&lt;br&gt;• COD₅ &lt; 2.5 kg/t&lt;br&gt;• Phosphorus &lt; 0.004 kg/t&lt;br&gt;• Nitrogen &lt; 0.05 kg/t&lt;br&gt;• Solid matter &lt; 0.8 kg/t&lt;br&gt;• Reliability of four oxidisers, power sufficiency</td>
<td>9.2 m³/t&lt;br&gt;0.16 kg/t&lt;br&gt;2.83 kg/t&lt;br&gt;0.0029 kg/t&lt;br&gt;0.031 kg/t&lt;br&gt;0.76 kg/t&lt;br&gt;OK **</td>
</tr>
<tr>
<td>Wastewater impact management</td>
<td>• Effluent flow &lt; 10 m³/t&lt;br&gt;• BOD₅ &lt; 0.23 kg/t&lt;br&gt;• COD₅ &lt; 2.5 kg/t&lt;br&gt;• Phosphorus &lt; 0.004 kg/t&lt;br&gt;• Nitrogen &lt; 0.05 kg/t&lt;br&gt;• Solid matter &lt; 0.8 kg/t&lt;br&gt;• Reliability of four oxidisers, power sufficiency</td>
<td>9.2 m³/t&lt;br&gt;0.16 kg/t&lt;br&gt;2.83 kg/t&lt;br&gt;0.0029 kg/t&lt;br&gt;0.031 kg/t&lt;br&gt;0.76 kg/t&lt;br&gt;OK **</td>
</tr>
<tr>
<td>- Preventive maintenance and continuous operational development at the effluent treatment plant</td>
<td>• Effluent flow &lt; 10 m³/t&lt;br&gt;• BOD₅ &lt; 0.23 kg/t&lt;br&gt;• COD₅ &lt; 2.5 kg/t&lt;br&gt;• Phosphorus &lt; 0.004 kg/t&lt;br&gt;• Nitrogen &lt; 0.05 kg/t&lt;br&gt;• Solid matter &lt; 0.8 kg/t&lt;br&gt;• Reliability of four oxidisers, power sufficiency</td>
<td>9.2 m³/t&lt;br&gt;0.16 kg/t&lt;br&gt;2.83 kg/t&lt;br&gt;0.0029 kg/t&lt;br&gt;0.031 kg/t&lt;br&gt;0.76 kg/t&lt;br&gt;OK **</td>
</tr>
<tr>
<td>Optimisation of the oxygenation pumping to deeps of Lake Lohjanjärvi</td>
<td>• Effluent flow &lt; 10 m³/t&lt;br&gt;• BOD₅ &lt; 0.23 kg/t&lt;br&gt;• COD₅ &lt; 2.5 kg/t&lt;br&gt;• Phosphorus &lt; 0.004 kg/t&lt;br&gt;• Nitrogen &lt; 0.05 kg/t&lt;br&gt;• Solid matter &lt; 0.8 kg/t&lt;br&gt;• Reliability of four oxidisers, power sufficiency</td>
<td>9.2 m³/t&lt;br&gt;0.16 kg/t&lt;br&gt;2.83 kg/t&lt;br&gt;0.0029 kg/t&lt;br&gt;0.031 kg/t&lt;br&gt;0.76 kg/t&lt;br&gt;OK **</td>
</tr>
<tr>
<td>Energy savings objectives for 2010 – 2016 according to the target programme</td>
<td>Energy savings&lt;br&gt;• 16.2 GWh</td>
<td>5.3 GWh</td>
</tr>
<tr>
<td>- Definition of savings projects in an energy analysis, CI and idea activities</td>
<td>Energy savings&lt;br&gt;• 16.2 GWh</td>
<td>5.3 GWh</td>
</tr>
<tr>
<td>Delivery of environmental information: Environmental Administration, Statistics Finland, Finnish Forest Industries Federation, the Environmental Register of Packaging, and impact monitoring</td>
<td>Within the schedules set</td>
<td>Reporting at the correct time</td>
</tr>
<tr>
<td>Cooperation with stakeholders: exchange of information and discussion</td>
<td>• Feedback processing 100%&lt;br&gt;• Bulletins&lt;br&gt;• Stakeholder events, meeting with neighbours</td>
<td>Feedback 6 pcs, reviewed Meeting with neighbours</td>
</tr>
<tr>
<td>- Feedback and meetings with neighbours, visibility in stakeholder events</td>
<td>• Feedback processing 100%&lt;br&gt;• Bulletins&lt;br&gt;• Stakeholder events, meeting with neighbours</td>
<td>Feedback 6 pcs, reviewed Meeting with neighbours</td>
</tr>
<tr>
<td>EMAS and ISO 50001 certification</td>
<td>• Ready in April&lt;br&gt;• Share of certified fibre &gt; 70%&lt;br&gt;• Ready in April</td>
<td>Ready&lt;br&gt;88%&lt;br&gt;Ready</td>
</tr>
<tr>
<td>CoC management</td>
<td>• Ready in April&lt;br&gt;• Share of certified fibre &gt; 70%&lt;br&gt;• Ready in April</td>
<td>Ready&lt;br&gt;88%&lt;br&gt;Ready</td>
</tr>
<tr>
<td>Paper Profile verified</td>
<td>• COD₅ &lt; 4,500 kg/t&lt;br&gt;• Phosphorus &lt; 7 kg/d&lt;br&gt;• Nitrogen &lt; 100 kg/d</td>
<td>4,841 kg/d ***&lt;br&gt;4.9 kg/d, 2 pcs Excess of monthly permit limits 53 kg/d</td>
</tr>
<tr>
<td>Compliance with environmental permit limits, permit limits, monthly and annual averages</td>
<td>• COD₅ &lt; 4,500 kg/t&lt;br&gt;• Phosphorus &lt; 7 kg/d&lt;br&gt;• Nitrogen &lt; 100 kg/d</td>
<td>4,841 kg/d ***&lt;br&gt;4.9 kg/d, 2 pcs Excess of monthly permit limits 53 kg/d</td>
</tr>
<tr>
<td>CO₂ t/a vs. CO₂ emissions rights</td>
<td>• Carbon dioxide emissions (fossil)&lt;br&gt;• Emissions into the air vs. permit conditions&lt;br&gt;• Boiler functionality vs. permit conditions&lt;br&gt;• Share of biofuel &gt; 23%</td>
<td>223,400 t, verified OK&lt;br&gt;25.5%</td>
</tr>
<tr>
<td>- Verification and emission surveys&lt;br&gt;Power plant emissions&lt;br&gt;- Functionality of purification technology&lt;br&gt;Commissioning of the new boiler&lt;br&gt;Efficient use of biofuel&lt;br&gt;- Fuel distribution monitoring</td>
<td>• Carbon dioxide emissions (fossil)&lt;br&gt;• Emissions into the air vs. permit conditions&lt;br&gt;• Boiler functionality vs. permit conditions&lt;br&gt;• Share of biofuel &gt; 23%</td>
<td>223,400 t, verified OK&lt;br&gt;25.5%</td>
</tr>
</tbody>
</table>

* In Finland, the specification method for biological oxygen consumption is BOD₅. BOD₅ = BOD₇/1.16.
** An interruption or power reduction caused by a gear failure in one oxidiser.
*** The annual permit limit was exceeded, the monthly limit was exceeded two times.
Objectives for 2016–2018

Annual environmental goals are based on the mill’s central environmental aspects. The goals can be measured and their fulfilment is monitored as defined in the operational system.

We strive to meet the mill’s very strict permit conditions under any circumstances. This can be fulfilled by operating according to laws and regulations, efficiently and improving continuously as indicated in our environmental policy.

The prevention of incidental releases and proper risk management incorporate parts of a responsible workplace and our environmental goals.

According to the goal of sustainable development, our objective is to minimise water consumption in processes and use raw materials and energy as efficiently as possible. Our aim in raw material efficiency is to have as low a solid matter loss as possible at the effluent treatment plant. Waste is utilised as extensively as possible.

As an environmental goal, cooperation with stakeholders stands for open and constructive relationships with our neighbours and other stakeholders. We are aiming at correctly timed exchange of information concerning current issues. All feedback is handled and responded to without any delay.

Certified wood chain of custody management systems and the EU Ecolabel, granted to our mill’s products, are examples of how we can fulfil the environmental expectations of our customers. Through the EMAS statement, we will regularly share information about the development of environmental affairs at our mill.

<table>
<thead>
<tr>
<th>Objectives in 2016</th>
<th>Key figure/indicator</th>
<th>Target value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Efficient waste sorting and utilisation</td>
<td>Utilisation rate</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Good management of environmental risks: Identification of risks, analysis of non-conformity, and preventive measures</td>
<td>Number of unexplained non-conformities causing disturbance at the power plant</td>
<td>0 pcs</td>
</tr>
<tr>
<td>No severe incidental releases</td>
<td>Number of incidental releases</td>
<td>0 pcs</td>
</tr>
<tr>
<td>Improvement of raw material efficiency and water management</td>
<td>Solid matter loss in wastewater</td>
<td>&lt; 15 kg/t</td>
</tr>
<tr>
<td></td>
<td>Effluent flow</td>
<td>&lt; 9.4 m³/t</td>
</tr>
<tr>
<td>Improved energy efficiency: Savings objectives for 2010–2016 according to the target programme</td>
<td>Energy savings</td>
<td>16.2 GWh</td>
</tr>
<tr>
<td></td>
<td>• Electricity, heat, fuel</td>
<td></td>
</tr>
<tr>
<td>Compliance with environmental permit limits: Levels below the annual and monthly averages (in brackets) of emissions into watercourses set out in permit limits</td>
<td>COD₅, Phosphorus, Nitrogen</td>
<td>&lt; 4,500 kg/d (6,000)</td>
</tr>
<tr>
<td></td>
<td>Emissions vs. permit conditions</td>
<td>&lt; 7 kg/d (9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt; 100 kg/d (130)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In accordance with permit conditions</td>
</tr>
<tr>
<td>Efficient use of biofuel</td>
<td>Share of biofuel</td>
<td>&gt; 23%</td>
</tr>
<tr>
<td>CoC management</td>
<td>Share of certified fibre</td>
<td>&gt; 70%</td>
</tr>
<tr>
<td>Development of the mill’s ISO 14001 environmental management system</td>
<td>Identification of change needs arising from the revised ISO 14001 system standard</td>
<td>Completed in 12/2016</td>
</tr>
<tr>
<td>Reduced COD₅ load conducted to the treatment plant</td>
<td>Surveys conducted according to the project plan</td>
<td>Completed in 09/2016</td>
</tr>
</tbody>
</table>
Glossary

**BOD** (Biological Oxygen Demand) indicates the amount of oxygen consumed by rapidly decomposing organic compounds contained in effluent in a seven day period when decomposing in a water system.

**CO₂** (carbon dioxide) is a product of burning carbon. Carbon dioxide appears naturally in small contents in the earth’s atmosphere. Carbon dioxide emissions emitted by humans are generated by traffic, energy production and industry. Carbon dioxide is a significant greenhouse gas, accelerating global warming. Plants use it as raw material in producing organic compounds, i.e. in photosynthesis.

**COD** (Chemical Oxygen Demand) is a method for measuring the chemical oxygen consumption of effluent. It shows the total amount of all organic matter in effluent – both biodegradable and non-biodegradable.

**EMAS** (Eco Management and Auditing Scheme) is a voluntary environmental management and auditing scheme based on EU directives. EMAS requires an environmental management system and the regular publication of statements.

**Phosphorus** (P) is a vital element for flora and fauna that is also found in wood. Phosphorus compounds serve as nutrients. In water, excessive phosphorus may cause massive algal growth, which can lead to oxygen depletion in the algal decomposition process.

**FSC®** (Forest Stewardship Council) is a forest certification system which promotes responsible, socially useful and financially profitable forestry considering the environment.

**ISO 14001** is an international environmental standard. It is part of the general management system which consists of organisational structures, planning functions, responsibilities, procedures, practices, processes and resources for developing, implementing, achieving, reviewing and maintaining environmental policies.

**ISO 9001** is an international quality management system standard.

**ISO 50001** is an international energy management system standard which offers methods for improving energy efficiency, reducing costs and improving the efficiency of energy operations. ISO 50001 has a similar structure to the ISO 14001 environmental management standard.

**Solid matters** include the fibre, fillers and coating agents contained in effluent. After biological purification, solids in effluent consist mainly of sludge particles that have been released from the treatment process.

**Fibre clay** is a moist by-product containing paper raw materials, fibre and pigments. Fibre clay is formed in preliminary clarification of effluent, and can be used in land construction to produce a structural layer which is watertight, and resistant to rupture and erosion.

**Forest certification system** contains standards, guidelines and rules for covering good management and use of forests, the verification of wood origins and the certification procedure. In forest certification, an impartial body issues a written statement that the forest concerned is managed in conformity with the forest certification criteria. There are several systems and their use varies geographically.

**NOₓ**, i.e. nitrogen oxides, are gases produced during combustion. In moist air, nitrogen oxides can form nitric acid which, in turn, is precipitated as "acid rain". This nitrogen-containing rain also has a fertilising effect i.e. eutrophication.

**OHSAS 18001** is a standard applied to the occupational safety and health management system.

**PDCA** (Plan–Do–Check–Act) refers to a continuous improvement system. Plan refers to planning, Do to implementation, Check to assessment, and Act to development.

**PEFC™** (Programme for the Endorsement of Forest Certification Schemes) is the most common forest certification system globally. It promotes ecologically, socially and economically sustainable forestry. The system is the most applicable to the Finnish family-owned forestry system.

**PEFC™ CoC** (Chain of Custody) refers to the verification of the origins of wood pursuant to the PEFC™ forest
certification system. It indicates the share of PEFC™ certified wood in the raw material.

**Pigments** are powdery substances, such as clay and calcium carbonate (lime) that are used in paper coating, among other things.

**PGW** (pressurised ground wood) refers to mechanical pulp manufactured by grinding where the process has been boosted using pressure.

**SARA** (SHEQ Auditing and Risk Assessment) is Sappi’s safety information system in which any environmental deviations, hazards and observations, accidents and fires are reported.

**Incidental release** is a severe, sudden and unplanned emission which can lead to adverse environmental impact outside the mill or cause the permit limits to be exceeded.

**SO₂**, i.e. sulphur dioxide, is generated when burning fuels that contain sulphur. When reacting with moist air, sulphur dioxide generates sulphuric acid, resulting in acid rain and acidification. Acidification damages the ecosystem.

**Nitrogen** (N) is a vital element for flora and fauna that is also found in wood. Nitrogen compounds serve as nutrients. When dissolved in water, excessive nitrogen may cause massive algal growth, which can lead to oxygen depletion in the algal decomposition process.

**Ultra-filtration** is a membrane filtering method which separates high-molecular compounds from low-molecular ones.
Sappi Europe is the leading European producer of coated fine paper used in premium magazines, catalogues, books and high-end print advertising. Sappi Europe’s head office is located in Brussels, Belgium. All mills that produce Sappi paper in the EU area are ISO 9001, ISO 14001, ISO 50001 and OHSAS 18001 certified and EMAS registered. The mills hold chain-of-custody certification under the FSC® (Forest Stewardship Council) and/or PEFC™ (Programme for the Endorsement of Forest Certification) schemes.

Sappi Europe is a division of Sappi Limited (NYSE, JSE), a global company headquartered in Johannesburg, South Africa, with nearly 13,000 employees, production in seven countries on three continents, sales offices in 50 countries and customers in over 100 countries around the world. Learn more about Sappi at www.sappi.com.

As an accredited environmental verifier (FI-V-0001), Inspecta Certification has examined the information of the environmental management system and environmental statement of Sappi Finland Operations Oy Kirkniemi mill. Following this examination, on 2016-03-30 the environmental verifier has herewith confirmed that both the environmental management system and the Finnish environmental statement are in compliance with the requirements of the EMAS Regulation (EC) No 1221/2009. The verification concerns only the version in Finnish.

The EMAS statement of Sappi Kirkniemi mill is published in Finnish and in English. The EMAS statement is available in PDF format on the Sappi website at www.sappi.com. Please send any feedback and questions to the environmental manager via e-mail to jenni.kukkonen@sappi.com or by calling +358 10 464 2116.

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