BILLERUD

Billerud Skärblacka AB
Environmental Statement 2003

Contents

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Preface

Billerud Skärblacka AB fits neatly into the ecologically sustainable society. Our raw materials are renewable and paper products can be recycled as raw materials or as environmentally friendly bio fuel.

Our production processes are environmentally adapted and environmental issues have played a key role in operations at Billerud Skärblacka AB for many years. As a result of investments in more benign processes and efficient treatment, emissions to air and water have been reduced in recent decades despite increased production. However, we cannot be satisfied with this because development must always be continuous. The permit issued by the Licensing Board for Environmental Protection in 1997 included a number of measures that are gradually being dealt with. Our largest-ever environmental investment was completed in the autumn of 1998 when the biological lagoon was rebuilt to reduce emissions to water. After adjustments of this treatment emissions to water were cut considerably. Emissions of phosphorous were at their lowest level ever in 2003.

We received the final conditions for our operations in 2003. The 1997 verdict set provisional conditions for emissions of phosphorous to water, sulphur and nitrogen to air, and noise levels. The Environmental Court and the Environmental Court of Appeal set conditions at the start and end of 2003 respectively.

Environmental work includes other issues than emissions. We need good environmental knowledge in order to act correctly in various situations. We therefore provide regular environmental training and information to our employees. During 2003 we succeeded in reducing oil consumption, excluding oil for backpressure power, per tonne of supplied products by 25%.

Our environmental management system is an important tool in our environmental work. One of the cornerstones of this system is our environment policy that sets guidelines for environmental work. Clear objectives and concrete plans help to ensure continuous improvement.

Our environment policy also states that we will be open and objective when dealing with authorities, employees, customers and the general public. A part of this is the 2003 Environmental Statement, which provides information about the mill, environmental management system and our products, and records our achievements and our objectives. The Swedish version of this Environmental Statement has been examined and approved by DNV Certification AB, which also audits our environmental management system twice a year.

Skärblacka, April 2004

Peter Davidson
Managing Director

Environmental Guidelines for Billerud Skärblacka

Good environmental protection is crucial for the development and future of the mill. For this reason, environmental issues are given high priority on both a short term and a long term basis.

Benign processes
We will comply with all legal requirements and strive to maintain a good margin to existing environmental conditions. We will strive to reduce the impact on the environment by using renewable raw materials, benign production processes with minimum consumption of resources, effective cleaning methods and environmentally adapted transports.

Environmentally adapted products
We will endeavour to produce and sell pulp and paper which meets the demands of the market and society. We will seek to minimise the impact on the environment during the full life cycle of our products. Environmental aspects are important in the development of new products.

Disposal of waste products
We will endeavour to decrease the amount of waste products and increase recycling in order to promote the sustainable cycle of nature.

Environmental Management System
Within the framework of our Environmental Management System we have an environmental action programme which includes objectives for the continual improvement of safety, production and cleaning processes. Our employees receive training to enable them to take responsibility for the environment in their daily tasks. We also encourage our suppliers and contractors to meet the same standards of environmental awareness.

Openness
Our manner of dealing with environmental issues is characterised by openness and objectivity in our dialogue with authorities, employees, customers and society.

Skärblacka 10 March 2003
Peter Davidson
Managing Director

These guidelines are founded on the Billerud´s Policy for Quality, The Environment and Social Responsibility.

Environmental Management System

Environmental issues have always been prioritised at the Skärblacka mill. The decision to introduce environmental management in 1995 was a natural step and included EMAS registration as well as certification in accordance with ISO 14001.

In the autumn of 1997 the system was audited and the mill was certified in accordance with ISO 14001 and registered in accordance with EMAS.

Management System

Working with environmental management systems means that, in all matters related to the environment, there are set rules or standards. Internationally there are above all two different systems, EMAS registration in Europe and ISO 14001 certification world-wide. The two systems are similar in many ways.

The quality control system at the mill has already been certified and work is being done in the field of occupational health and safety. The mill has combined these systems into one management system.

Environmental aspects

One of the most important parts of an environmental management system is to identify environmental aspects (see also pages 12-13) as well as legal and other external requirements, and then evaluate them and set environmental objectives.

Education in 2003

Education is essential. In the autumn of 2003 training was provided for all new employees. This included general information about global and national environmental issues, forestry, forest industry cycles and environmental work performed by the forest industry. The second part dealt with environmental work at the Skärblacka mill, including processes, environmental protection measures, permits, monitoring, life cycle analyses and the environmental management system.

Supplier assessment

Another important aspect is working on environmental issues together with our suppliers. During the year we have made assessments of two of our suppliers whose products are classified as significant environmental aspects or whose products have an impact on the mill's significant environmental aspects. Discussions have been started with suppliers about measures that can be implemented to achieve environmental improvements.

Review of environmental work

Daily checks

Environmental work at the mill is checked daily through various measurements and analyses (self-inspection). There are set routines for unusual situations and preventive measures.

Four audits per year

Audits of environmental work are performed four times per year. Two of these audits are performed by the mill's own auditors and two by external, independent auditors.

Management review

Management does an annual review of the environmental management system. A follow-up is carried out to ensure that the system has been effective and that continuous improvement is being made. The 2003 review covered the operations system, policy, environmental objectives, internal audits, near-accidents and deviations, legislation and other requirements.

Environmental guidelines

Within the Billerud group there is a comprehensive policy for quality, the environment and social responsibility. To clearly define our commitment detailed environmental guidelines have been set out.

EMAS (Eco Management and Audit Scheme)
The EU's environmental management and environmental audit regulation.

ISO 14001
The International Organisation for Standardisation ISO's standard for an environmental management system.

Environmental Aspects
Emissions from the mill and consumption of resources by the mill.

Billerud Skärblacka AB

Billerud Skärblacka AB is a member of the Billerud Group. The mill has an annual production capacity of approximately 400,000 tonnes market products, the majority of which is exported. Turnover is approximately SEK 2 billion per year.

Location

The mill is located in Skärblacka, a small community by the River Motala, upstream from Lake Glan. The community has around 4,000 inhabitants; approximately 750 people are employed by the mill, one of the most important employers in the Municipality of Norrköping.

The River Motala runs from Lake Vättern through Lakes Boren, Roxen and Glan before passing through Norrköping and running out into the Baltic Sea. The area is a very important farming district. The river and many of its tributaries are used for water supply and for water discharge for a large number of communities and industries. As a result the impact on Lake Glan is relatively high.

Old tradition

Paper production at the Skärblacka mill started more than 120 years ago. The traditions have been handed down from one generation to another.

The foundations of today's modern mill were laid in the early 1960s, when a totally new sulphate pulp mill and two new paper machines were built. Over the years further major investments have been made on new technology and new production facilities, thus ensuring that the Skärblacka mill maintains its position as a modern pulp and paper mill.

Technical advances and intensive product development have made the mill one of Europe's largest producers of packaging paper. Along with the investments which have been made, many environment protection measures have been taken and this has resulted in very low emissions to water and air.

Our green base

In 2003 pulpwood for the mill was supplied by Sveaskog, Örebro. Sveaskog is Sweden's largest forest owner, with 4.6 million hectares of land, of which 3.5 million hectares is productive forest. This represents around 15% of productive forest in Sweden.

Since the mill is located some distance from Sveaskog's forests, wood is exchanged with other forest owners to minimise transports. Sveaskog's environment policy for its forestry activities commits the company to developing sustainable use of the forest's various natural assets and to realising national environmental targets.

In 2003 around half of pulpwood came from Sydved, Holmen and Södra. These companies have policies similar to Sveaskog, committing them to ecological and sustainable activities. Around 8% of pulpwood was imported from the Baltic states and Russia. Due to co-operation between Sveaskog and other forest owners, the average transport distance for pulpwood was 92 km in 2003.

Skärblacka mainly uses pine and spruce, both of which have long and strong fibres. This is necessary in order to

Recipient
The part of the environment near a plant, e.g. air and water, which receives emissions.

Hardwood
Normally birch. Hardwood has shorter fibres than softwood. The most important ingredient in fluting as well as writing and printing paper.

Softwood
Wood from coniferous trees, such as pine and spruce. Has longer and stronger fibres than hardwood. The most important raw material for strong paper.

Fluting
The rippled or 'wavy' middle layer in corrugated board, produced from either new or recycled fibres.

Corrugated board
Manufactured by gluing two flat layers of paper (liner) with a rippled layer (fluting) in the middle.

Sack paper
Paper with high strength properties used for the production of sacks. Made from softwood sulphate pulp.

MG-papper (Mono Glazed Paper)
Paper which is dried on a highly polished Yankee cylinder thus producing paper which has a very smooth, glossy surface on one side. Used for packaging with strict hygiene requirements.

Strong paper is what Billerud Skärblacka AB concentrates on. The mill's four paper machines produce fluting, the 'wavy' middle layer in corrugated board, strong sack paper and MG paper which, among other things, is used in the food industry.

produce strong sack and kraft paper. The mill also uses hardwood, mostly birch and aspen. With their short fibres they are suitable for making stiff paper. As a function of this our fluting, the "wavy" paper used in corrugated board is produced from hardwood. An addition of hardwood fibres in different types of paper results in a smoother surface and improved printing quality.

Packaging paper

The majority of the approximately 400,000 tonnes produced for sale each year is paper from our four paper machines; about 20% of production is sold as market pulp.

We concentrate on producing unbleached sack paper, white MG kraft paper and fluting. The Skärblacka mill specialises in packaging paper.

Our customers are packaging manufacturers throughout the world. They are constantly developing their products and as a result higher demands are continually being made on our paper.

Our customers also demand that our products be processed in as environmentally friendly a manner as possible.

Over and above the demands made by customers, the EU's packaging directive makes demands on collection and recycling as well as on the form/design of packaging. We are able to satisfy these demands thanks to intensive research and development.

The trade and industry group, Miljöpack, whose goal is to develop a self-inspection system to meet the packaging directive's demands, has assisted in the work of producing more environmentally friendly packaging.

Many end uses

Our paper is used in many of the products you see or use daily in Sweden and abroad. Our paper is often used in combination with other materials in packaging.

At the breakfast table you can see our paper in the packaging for margarine, as the inner lid on a butter packet, as a wrapper for crisp bread or as a bag for fresh breakfast rolls. Packaging for such diverse items as postcards, TV sets, furniture, spare parts for cars, chemicals, cement and fodder is also made out of paper from Skärblacka.

Our paper is also used in health care. A special product is used in the packaging of disposables and surgical instruments that are to be sterilised.

All these different types of packaging make heavy demands on our paper. The runability must be perfect even when our customers' large and wide coating machines, corrugating machines or printing presses are operating at full speed. The same runability is required for machines that produce and fill the final package.

Production Process

Production goes on 24 hours a day, year round. About half of the mill's 750 employees work in production. From their computer screens, process operators control the machines and production units and the environment is an integrated part. Many specialists also work at the mill, in maintenance, process and product development, environment, marketing, purchasing – the list is endless. Machines and environmental protection units are trimmed continuously to meet the increasing demands for both better product quality and environmental protection. The pulp and paper production process is highly complex. It is the combination of raw materials, technical processes and skilled personnel that ensures the best result.

1. First the wood is cut into chips
When the wood arrives in Skärblacka, it is taken into the wood room. The logs are barked in a rotating barking drum. After barking, the logs are cut into chips about 25 mm in size and stored in large chip silos, while the bark is used as fuel. Chips produced as a by-product in the sawmill industry are also bought. The chips are blown from the silos along conduits into the digester houses.

2. Cooking the chips in the sulphate mill
Strong paper is produced in Skärblacka so it is important not to damage the cellulose fibres in the pulping process. They have to be separated from each other carefully. The wood fibres are held together with a binding agent called lignin, which is dissolved by chemicals used in the cooking process. The cooking liquor, so-called white liquor, turns black and becomes black liquor. About half of the wood becomes pulp. The rest of it is dissolved in the black liquor and will be used as bio fuel in the soda recovery boiler. During the cooking odour substances arise.
The cooking takes place in two different lines. Line 1 consists of six batch digesters, where chips and white liquor is mixed and the chips are cooked for about 3-4 hours. The pulp then moves on in the process. On Line 2 there is a digester which works continuously. Chips and white liquor are added at the top continuously and the pulp, partly washed, is blown out at the bottom.

3. Thorough washing
After cooking, the pulp is washed in several stages to separate the black liquor from the fibres and the black liquor is sent to chemical recovery.

4. Continued cleaning of the pulp
After cooking and washing, the pulp is screened to remove solid impurities. Up to this point the process is totally closed and all liquids are taken care of.
After that the pulp from Line 2 is pumped directly to the biggest paper machine for production of unbleached sack paper and from Line 1 to the bleaching plant.

5. Bleaching the pulp
The bleaching process removes the last of the lignin, wood resins, etc. and what remains are the clean, white cellulose fibres. The bleaching process gives a cleaner, whiter pulp

Lignin
Wood substance that makes up about 30% of the total wood content. Lignin is extracted in the cooking process in pulp making and is burnt together with dissolved carbohydrates as bio fuel (black liquor) in the soda recovery boiler for energy production.

Bio fuel
Renewable fuels originating from the plant kingdom such as from wood, incl. black liquor and bark. Is included in the cycle of nature.

Bleaching
Chemical process used to produce a pure bright (white) and stable pulp. In Skärblacka environmentally adapted ECF-bleaching is used without chlorine gas.

Lime kiln
Important part of sulphate pulp mill's chemical recovery system. Lime sludge (calcium carbonate) is burnt in this kiln to produce lime.

Sulphate pulp
Chemical pulp produced by cooking wood under high pressure and at a high temperature in liquor, known as white liquor (sodium hydroxide and sodium sulphide). Sulphate pulp is also known as kraft pulp.

Semi-chemical pulp
Pulp where the fibres are separated through a combination of chemical and mechanical processing (refining).

Pulp production in the fluting mill

Semi-chemical pulp (NSSC-pulp) and recycled fibres are used in the production of fluting on PM4 instead of sulphate pulp.
In production of the semi-chemical pulp, the cooking process takes less time than in the sulphate mill, so 80% of the wood becomes pulp and the rest remains in the spent liquor.
Since a large portion of the lignin remains in the pulp, binding the fibres, these must be separated in refiners. The spent liquor which has been washed out is evaporated and combusted in the soda recovery boiler together with the black liquor from the sulphate mill.
Recycled fibres used at the mill are made up of corrugated board which has been collected and wastage from production. Bales of recycled fibres are dissolved in water. Plastic and other impurities are removed before the pulp can be used.

which is more resistant to ageing. Since 1992 so-called ECF-bleaching has been used at Skärblacka. This means that no chlorine gas is used. The chemicals used are oxygen, chlorine dioxide, hydrogen peroxide and sodium hydroxide. The wood substance, which is dissolved in the oxygen step, is washed out and recycled together with the black liquor to the soda recovery boiler. The environmentally adapted ECF-bleaching results in a significant reduction of emission of oxygen-consuming and chlorinated substances (see also page 21).

6. Production of paper and market pulp

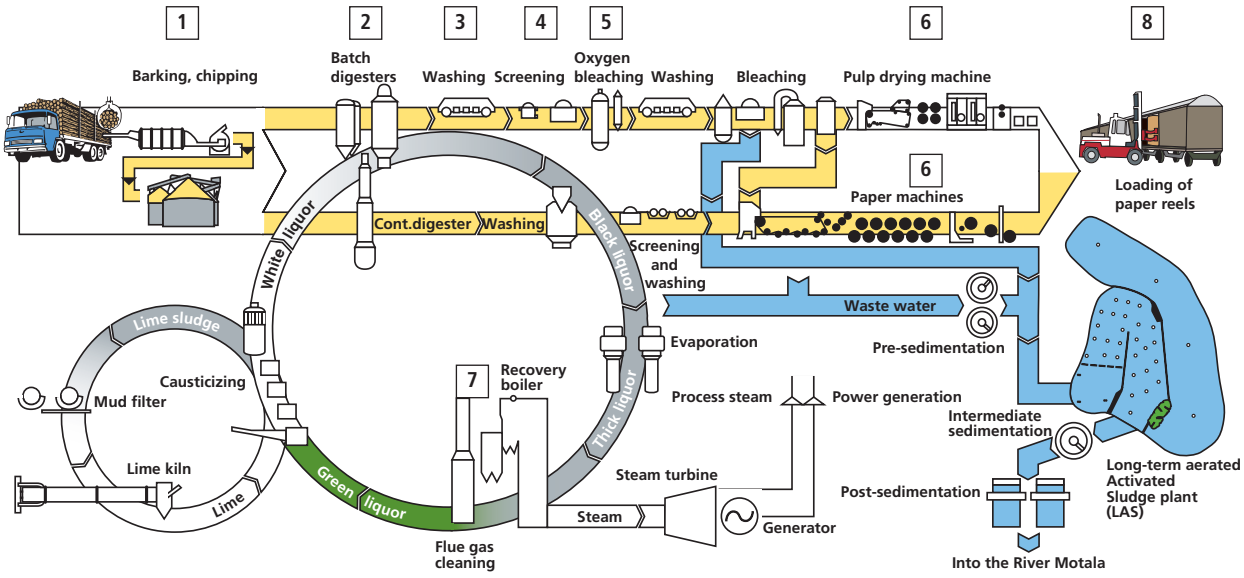
After bleaching, a portion of the pulp goes to the drying machine and after being dried it is cut in sheets for sale to other paper mills. The majority of pulp is used for paper production on the mill's four paper machines.

7. Recovery of chemicals and energy

The black liquor, produced in the cooking process, is evaporated and combusted in the soda recovery boiler. The dissolved wood substances become heat for steam and electrical production, while the chemicals form a melt which dissolves in water to become green liquor. The green liquor is treated with lime and converted into new cooking liquid (white liquor) which is recycled to the digester house. The lime becomes, at the same time, lime sludge which, in another recycling process, is burnt to new lime in lime kilns. This recycling of chemicals in different processes is a necessity for both the environment and the economy in a sulphate mill.

8. From the warehouse out into the world

Our paper is made in accordance with our customers' demands and specifications. The paper is delivered on reels which weigh an average of one tonne. Our automatic fork-lifts collect the reels from the paper machines and transport them carefully to the packing department. Then they are taken directly to the warehouse to be shipped to every corner of the world by boat, train or lorry, depending on their destination. About 80% of our production is exported.



Purifying waste water

The water is purified in sedimentation basins and with biological treatment. See also pages 18-19.

Paper Machines and Drying Machine

PM9 produces unbleached sack paper
PM9 is Skärblacka's largest paper machine and it is also one of the largest of its kind in the world. It is a so-called Fourdrinier machine and produces approximately 140,000 tonnes of unbleached sack paper per annum. It produces paper at a speed of 800 metres/minute; the width of the paper is 6.5 metres. One of the most important characteristics of sack paper is its strength. Our paper is used to make sacks for products such as chemicals, cement and fodder – products with heavy demands on the quality of the sack both during filling and transportation.

PM7 and PM8 produce MG kraft paper
PM7 and PM8 are two Yankee machines, which means that the paper is dried on a Yankee cylinder, a huge steam-heated steel cylinder with a super-polished surface. This process gives the paper a very smooth and glossy surface on one side and the paper is thus called Mono Glazed paper, or MG paper for short. Both PM7 and PM8 produce a strong white MG paper with a total annual capacity of approximately 85,000 tonnes. The paper is used in the food industry, in medical packaging and for bags. Furthermore the paper is also used as the base for many combinations such as aluminium lamination and polyethylene coating. PM7 has a width of 4.7 metres and a maximum speed of 600 metres/minute. The corresponding data for PM8 are 5.0 metres and 800 metres/minute.

Production of market pulp
The drying machine, TM1, produces approximately 80,000 tonnes of bleached market pulp per annum and this is cut into sheets and baled. This grade of pulp is sold to other paper mills where it is used in the production of copying paper and printing papers.

PM4 produces fluting
PM4 is a Fourdrinier machine with an annual production of approximately 90,000 tonnes. Fluting is the "wavy" middle layer of paper in corrugated board. PM4 produces 460 metres/minute, 4.4 metres wide.

Significant Environmental Aspects

Production of pulp and paper is an industry that requires permission from an environmental court. In July 1997 the mill's permit was renewed, which means that production could be increased by 30% while emissions had to be reduced further. The decision is based on a permit application which contains a detailed description of the mill's environmental impact. Remaining issues in the permit were resolved in verdicts delivered by the Environmental Court in February 2003 and by the Environmental Court of Appeal in November 2003. The most important tasks in the environment field now facing the mill are to meet the new, stringent permit conditions.

The following significant environmental aspects have been identified.

Consumption of raw materials

Liquid caustic soda – Consumes mainly cooking salt and electricity at the supplier.

Used a great deal in Skärblacka. Good access of raw material. High energy consumption in production of liquid caustic soda.

Sodium chlorate – Consumes mainly cooking salt and electricity at the supplier.

Medium usage in Skärblacka. Raw material is easily accessible. Very high energy consumption in production of sodium chlorate.

Heating energy – Some usage of fossil fuels, a non-renewable resource.

Oil consumption must be reduced because oil is a non-renewable resource.

Electrical energy – Requirements are met through own production and purchased supplies, so there are effects at the mill and at suppliers.

Some usage of fossil fuels in own production of electricity. Consumption of non-renewable resources must be restricted.

Water – After usage, water returns to the River Motala.

The amount of waste water has an impact on purification externally because an increase in the amount of water results in a decrease in the purifying effect.

Emissions to water

COD – Emissions that consume oxygen in the recipient water.

Up to and including 1998 the mill's contribution to Glan amounted to approximately 15% of the organic substances. The introduction of LAS resulted in emissions being reduced by half. Is still considered as a significant environmental aspect.

Phosphorous – Fertilising substances.

Up to and including 1998 the mill's contribution to Glan was approximately 20% of the phosphorous. The introduction of LAS resulted in a reduction of approximately 75 %. The emission level is still considered a significant environmental aspect.

Emissions to air

Sulphur compounds – Emissions that have acidifying effect and are responsible for odour.

There is a risk of odour in the area. A follow-up is done by environmental observers. See pages 24-25.

Nitrogen oxides – Emissions that are both acidifying and fertilising.

The mills emissions have a medium-sized impact on the area.

Carbon dioxide, fossil – The most important greenhouse gas.

It is important to reduce emissions of carbon dioxide from non-renewable fuel.

Transports (primarily products) – Air emissions that are acidifying and fertilising.

Investigations show that transports are a serious source of emissions. These transports are primarily to customers.

Noise – Noise in the area.

The mill is a source of noise and it is important to avoid noise disturbances in the area.

Residual products

Waste products to the tip – The dumping of waste products takes space and results in leachate.

Recycling or alternative usage is important in order to reduce consumption of resources and to minimise the impact on the environment.

Potential risks

Environmental risks – Different types of disturbances in the area can occur.

Some risks are considered significant environmental aspects. These risks usually occur at the start-up of production and when there is a stop in production.

Foundation for Environmental Work

Emissions to water and air as well as noise and residual products (waste) occur at many stages in the production. Active environmental work involves taking every possible opportunity to limit those aspects at the source by adapting the processes thus making them more environmentally friendly. Measures taken can be complemented with special cleaning devices. All types of emissions, mentioned on page 16 and 22, are checked in accordance with the comprehensive programme of monitoring.

Lab monitoring and reports
Emissions from the mill must be monitored. This is done using a comprehensive monitoring programme established by the County Administrative Board. Monthly reports are sent to different environmental authorities. In order to perform the analyses, the lab must be approved by Swedac, the national authority. Furthermore, impartial experts inspect the mill on an annual basis.

Objectives for improvements to the environment
It is unavoidable that a large pulp and paper mill will have an effect on the environment. The emissions and the consumption of resources can both be described as environmental aspects.

Every year a list of environmental aspects is prepared. At the same time an evaluation is done of those considered significant; see pages 12-13.This provides the foundation for establishing environmental objectives for the up-coming year. In this way we work with continual improvements in order to reduce the effect on the environment. Additional information concerning the model used is available by contacting those responsible for the Environmental Statement (see pg. 2)

Monitoring programme
A document that states the checks that must be made to ensure that emission requirements and other legal requirements are being met.

Impact of transports on the environment
Investigations have shown that a large portion of the total emissions to air are from transports. Special guidelines have therefore been established. We measure the environmental burden of different types of transports in accordance with a special model.

An agreement with Green Cargo and their German counterpart has resulted in a number of transports being shifted from lorry and boat to rail, resulting in a decrease in use of fossil fuels and emissions to air.

The sustainable cycle of nature and raw materials
The most important raw material is the forest which is a renewable resource. Our products are also well suited to recycling and can be used in the production of new packaging paper. A wood fibre can be recycled 4-5 times, thus being part of a 'wholesome' cycle.

When the fibre can no longer be recycled it becomes a source of energy when burnt thus reducing consumption of oil. When burnt, or if the paper is allowed to rot, carbon dioxide is produced which forests use in photosynthesis process.

In this way, paper closes the sustainable cycle of nature. Products that are based on renewable resources are well-suited to a society which is focused on the sustainable cycle of nature.

Only approved chemicals
Different types of chemicals are used in the processes. Those which are used in production of pulp are circulated in the processes as previously described. Different chemicals are used at other stages of the process as well. These must be approved by a group who checks their impact on the outside environment, the working environment and the products. A careful check has also been done by impartial experts. More environmentally adapted chemicals are being used in the processes.

Water is purified and circulated
Water used in production comes from the River Motala. Before it can be used it must be purified mechanically. A portion of the water must also be purified chemically in

Many different types of environmental analysis are performed at the mill's laboratory, which is accredited by SWEDAC, the national authority.

order to ensure that the bleached products are clean. The water that is used in production of steam must also pass through ion exchangers so that it is cleaner than distilled water. Clean cooling water and water with little contamination can be released directly into the River Motala after usage. Most of the other process water is circulated in the factory before it is finally cleaned and released.

High portion of renewable energy

Burning of bark and black liquor (bio fuel) supplies around 85% of the mill's energy requirements, excluding purchased electricity. The rest comes from oil and LP gas. Around 20% of electricity comes from the mill's own turbine.

Emissions to Water

Around 85% of fibres and suspended solids are removed in wastewater sedimentation ponds at the mill. The solids are used as bio fuel in the mill's bark boiler and the water is diverted to the biological treatment plant.

Emissions to water consist mainly of components from the wood used in production. Various wood components from barking and washing the wood in the wood room end up in the wash water. Different components in the wood (lignin, carbohydrates, resins, etc.) are decomposed during cooking and bleaching and are washed away to leave pure, white cellulose fibres. The components that are washed away go to the recovery boiler or wastewater purification.

The emissions of different substances are reduced both in the process and through the use of special purification methods.

- Some substances consume oxygen when they are discharged and decomposed in the recipient water. That oxygen consumption is measured as BOD and COD. Such emissions come from most of the production departments, but particularly from the manufacture of pulp and fluting.
- In the bleaching plant small amounts of chlorinated substances are formed and they are measured as AOX.
- Solid particles can consist of fibre from different production departments, sludge from the biological treatment or lime sludge from recovery of chemicals. These emissions are measured by filtration and are called suspended solids (SS).
- Phosphorous (P) and nitrogen (N) are fertilising substances that are mainly present in the wood and the intake water.

BOD Biochemical Oxygen Demand
Biochemical oxygen demand is a measure of the amount of oxygen that is used by micro-organisms in 7 days' decomposition of the emission.

COD Chemical Oxygen Demand
A measure of the amount of oxygen needed to complete oxidation of organic matter in water.

AOX
Collective term for the quantity of chlorine bound in organic compounds. It is formed during bleaching of pulp with chlorinated chemicals, but is also formed naturally.

Measures for protection of water

Large-scale environmental measures have been adopted at the Skärblacka Mill over the years. The following are considered to be the most important in recent times.

Most of the action taken has been internal, in the mill, related to improvements in the process.

- In the middle of 1986 oxygen bleaching was installed making it possible to recover dissolved substances from that stage for energy production in the recovery boiler. The emissions of AOX from the bleaching were thereby reduced by half.

The mill's wastewater is treated biologically in a LAS plant, which has replaced the aerated lagoon.
Photograph: Mats Karlsson

• The pulp washing after cooking and oxygen bleaching has gradually been improved and more of the dissolved wood substances can be recovered for combustion. The latest example of this is a new pulp washer which was installed in 2001 in the unbleached sulphate line.
• Process closing means that process water is circulated to a greater extent and is re-used and as a result, emissions are decreased.
• In 1992 the bleaching in the mill was changed to environmentally adapted ECF-bleaching (elemental chlorine-free) by increasing the use of chlorine dioxide.
• In 1996 a new pressurised bleaching tower for alkali, peroxide and oxygen was installed and use of chlorine dioxide has thus been reduced.

The measures taken internally by the different departments have been supplemented with what is called external purification of the mills wastewater from the process.
• Approximately 85% of the fibres remaining in the wastewater are removed in the sedimentation ponds. The removed fibres are used as fuel in the bark boiler.
• An aerated lagoon for the biological purification of wastewater was built in 1976, the first of its kind in Sweden at a mill with a bleaching plant. The lagoon is situated 1.5 km. south-west of the mill in the forest. The conversion to more efficient purification (the LAS technique) was concluded in the latter part of 1998. Since then there has been a considerable decrease in emissions .

Phosphorous (P)
A chemical element naturally present in wood. Discharges to water can cause nutrient enrichment, leading to luxuriant plant growth and subsequent oxygen deficiency when the plants decompose – a process called eutrophication.

Nitrogen (N)
A chemical element naturally present in wood. Discharges of nitrogen to water can cause nutrient enrichment, leading to luxuriant plant growth and subsequent oxygen deficiency when the plants decompose – a process called eutrophication.

Aerated lagoon
Previously used biological treatment method which reduces the BOD, COD and AOX content of effluent.

Description of wastewater purification/LAS

Pre-sedimentation

Wastewater from the paper mill, the sulphate mill (except the bleaching plant), fluting and the wood room goes to two lagoons each of which holds 1,420 sq. m. About 85% of the particles, mainly fibres, sink to the bottom. This sediment is pumped to de-watering where it is pressed until the dryness is 35-40%. The sediment is blended with bark and is then finally combusted in the bark boiler.

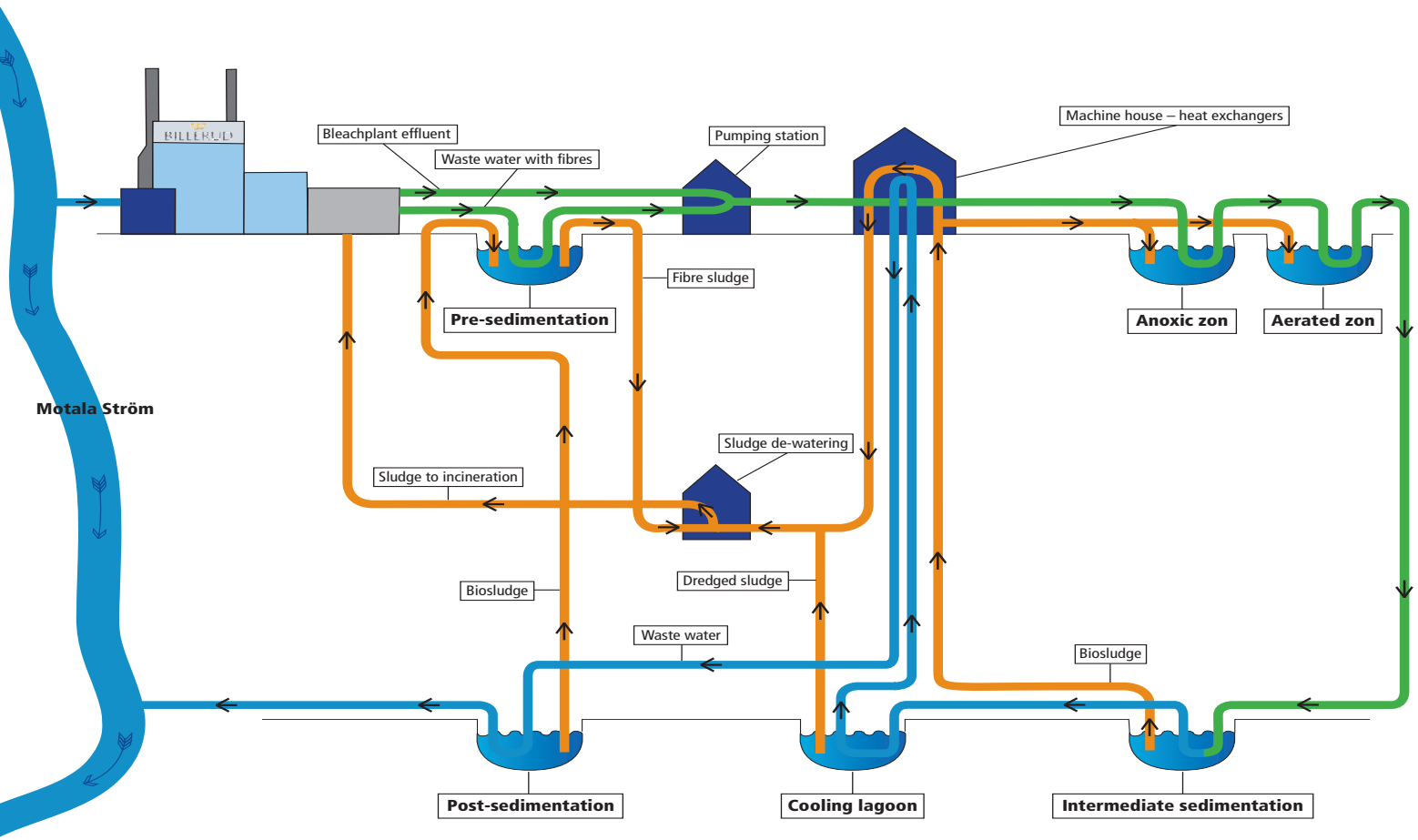
The purified water from pre-sedimentation is pumped, together with the wastewater from the bleaching plant, along an l.5 km. long pipe to LAS.

LAS – Long-term aerated Activated Sludge plant

This plant consists of a machine house with a heat exchange system for cooling incoming wastewater, three lagoons and an intermediate sedimentation lagoon. The first lagoon has a volume of 20 000 cu.m. and is called an anoxic (low-oxygen) zone. Three stirring devices keep the water well-blended. The primary task of the anoxic zone is to reduce chlorate ions and support micro-organisms which are necessary for effective purification.

The next lagoon is decidedly larger, 86,000 cu.m. and is called an aerated zone. 27 surface aerators ensure that the water is rich in oxygen and that the micro-organisms (bio-sludge) do not sink to the bottom. In the aerated zone the micro-organisms break down oxygen-consuming substances and at the same time they use phosphorous and nitrogen.

From the aerated zone water is moved to an intermedi-



Attached ciliates, so called colonial attached ciliates, on a sludge flock. The ciliates effectively clean the water, removing free-swimming bacteria.

Free-swimming ciliate. Diameter approx. 0.05 mm. Ciliates have cilia which are used for manoeuvring and catching food.

Rotatorie, approx. 0.1 mm. long. It uses cilia to start movement in the water and thus manoeuvre bacteria into its mouth. They are very effective and can eat hundreds of thousands of bacteria per day.

Photograph: Malin Carlsson

ate sedimentation lagoon where the micro-organisms sink to the bottom. Most of the separated bio-sludge is returned to the anoxic and aerated zones. The oldest bio-sludge is removed, de-watered and combusted.

The last lagoon in the LAS plant is a cooling lagoon with a volume of 150 000 cu.m. As the water passes through the cooling lagoon, the temperature decreases several degrees. The out-going water is used to reduce the temperature of the wastewater which enters the LAS. The temperature of the wastewater entering LAS should be approximately 37 degrees because it is at this temperature that bacteria work best.

Dredging of the first half of the cooling lagoon using a sludge float was started in 2002. Dredged sludge is dewatered and then burnt. The purpose of dredging is primarily to reduce emissions of phosphorous and nitrogen.

Post-sedimentation – the final step in purification

The water from the cooling lagoon goes to two sedimentation lagoons. At this stage, smaller amounts of bio-sludge, those remaining after passing through the LAS plant, sink. This sludge is pumped to the pre-sedimentation and the purified water goes out into the River Motala.

The three purification steps

Pre-sedimentation – Started 1963
LAS – Started 1998
Post-sedimentation – Started 1976

Wastewater from the Skärblacka mill is cleaned biologically in the LAS plant. There are approximately 200 tonnes of micro-organisms in the system, primarily bacteria. These bacteria break down pollutants in the wastewater and thus play an important role. It takes approximately 4 days for the water to pass through the purification system.

In LAS there are free-swimming bacteria as well as flocculated bacteria. The disadvantage with the first is that they are unable to become sediment but instead are carried in the wastewater to the recipient. In order to minimise the amount of free-swimming bacteria in the water which leaves LAS, the system also has different types of micro-organisms which feed primarily on free-swimming bacteria. Some of these organisms are shown above.



Environmental Impact on Water

Farming, municipalities and industries situated along the River Motala and its tributaries have had a considerable impact on Lake Glan. In the environmental impact assessment provided to the Licensing Board in 1996, specialists in the field (the Swedish Environment Research Group) outlined how the operations at the Skärblacka mill affect Lake Glan. The following is a short summary of the comprehensive report:

- There are large quantities of edible fish in the lake.
- The health of the fish is not affected by the wastewater.
- The water is nutritious and phosphorous is critical for controlling algae growth.
- The mill's contribution to the lake amounts to approximately 15% of the organic substance (COD), approximately 20% of the phosphorous and approximately 6% of the nitrogen.
- The mill's future emissions will be at least halved and this is particularly important when it comes to phosphorous.

In 1994 researchers from the University of Linköping studied the influence on drinking water in Norrköping and stated:

- The fresh drinking water does not deviate from water from normal, functioning water purification plants.
- The mill probably contributes to some increase in AOX but contributions from other sources are far greater.

Since the studies were completed the emissions have decreased considerably thanks to more efficient biological treatment. This has also resulted in a reduction of the impact on the environment.

Reduced emissions to water

In Appendix 2 details are given concerning emissions to water during the last five years. To put these emissions in perspective it is interesting to see the development over a longer period.

The graphs, on page 21, show the effects of many years of environmental measures on two of the most important types of emissions.

The diagram for BOD and production covers the period from the beginning of the twentieth century up to the present day. Measurements have been taken since 1976; figures prior to that are based on knowledge of the mill design and size during that period. Although these calculations may not be exact, a good picture is provided of the changes in emissions over the years. As the diagram shows, emissions increased at the same rate as production until 1960 and after that, despite a continued increase in production, we see a marked reduction in emissions due to the environmental measures taken and also as a result of the closing down of antiquated parts of the mill.

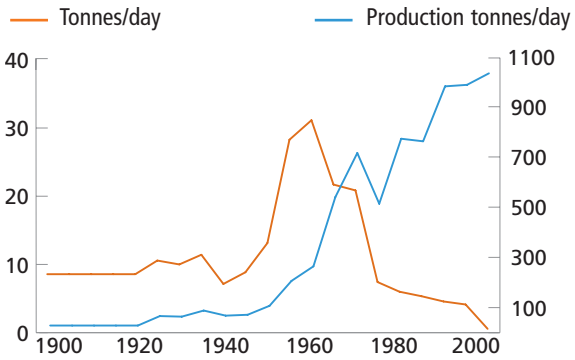
Since 1988 a standardised method has been used for the measurement of AOX. Before that AOX was calculated using another method (TOCI). The diagram shows that the AOX emission has been reduced by more than 95% as a result of oxygen bleaching, chlorine gas-free bleaching and improved biological treatment.

Environmental impact description
Investigation of the impact a special operation has on the environment.

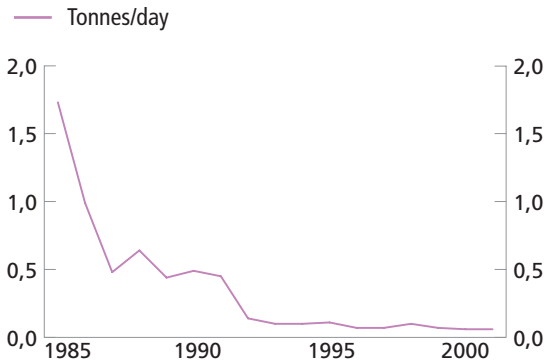
Licensing Board for Environmental Protection
This body managed the permit and concession procedures that large industrial sites were obliged to submit themselves to up to 1998. The Board was replaced by environmental courts in 1999.

Continuous measurements are performed at the mill. The picture shows technicians calibrating a meter that registers wastewater flows into the River Motala.

Emission of Biochemical Oxygen Demand (BOD)



Emission of Chlorinated Organic Compounds (AOX)



Dust levels are measured at three places, four times a year. The picture shows dust being measured after the lime kilns.

Emissions to Air

Types of emissions

Sulphur dioxide (SO_2), which is acidifying, is formed at combustion in the recovery boiler, bark boiler, oil-fired boiler, lime kilns and odour destruction incinerators.
Nitrogen oxides (NO_x), which are both acidifying and fertilising, are formed at combustion in boilers and kilns.
Dust from small particles of sodium salt, bark ash or lime comes from the recovery boiler, bark boiler and the lime kilns.
Odour that is mainly caused by hydrogen sulphide and organic sulphur compounds is formed in the cooking process and may be emitted from different places in the sulphate mill and the semi-chemical mill as well as the recovery boiler and the lime kilns.

Measures for environmental protection of air

Electrostatic filters on boilers and lime kilns separate most of the dust in the flue gases.
Scrubbers on the boilers wash the flue gases with different liquors. This leads to the reduction of approx. 95% of sulphur dioxide and a further reduction in the dust emission. In the scrubber on the recovery boiler, heat energy is also recovered. In the bleaching plant a scrubber is used to reduce the emission of chlorine dioxide in the ventilation.

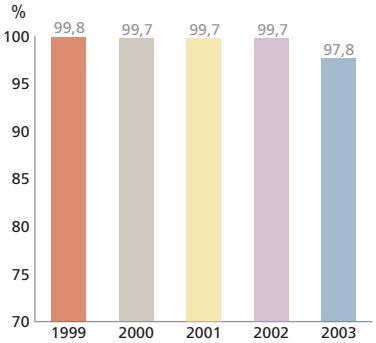
A completely new **odour destruction system** was installed in 1996. Strong and weak smelling gases are gathered from many places in the sulphate mill and combusted effectively in a new incinerator with low NO_x emissions. As a reserve, there is a conventional incinerator and as another reserve, a scrubber. As a result of the new system, the emissions of odorous substances have been reduced substantially but they have not been entirely eliminated.

Environmental impact on air

The mill's impact on the surrounding air was illustrated in the environmental impact assessment for the Licensing Board for Environmental Protection in 1996. Measurements and calculations made by independent experts showed that:

- Emission to air from the mill account for a small portion of regional acidification, i.e. the main part of acidification substances come from other parts of Sweden and from other countries.
- The measured concentrations of sulphur dioxide and nitrogen oxides near the mill is much lower than the limits for air quality established by the Swedish Environmental Protection Agency.

Skärblacka's Environmental Department has made new calculations of how much the mill accounts for total emissions of nitrogen oxides and sulphur in the county. Based on the most recent figures for emissions in the county in 1998, the mill accounted for 6% of nitrogen oxides and 14% of sulphur in 2003.



Burning of odorous gases, percentage of time

A measurement of odour destruction availability is the amount of time during which odorous gases are burnt. Availability in 2003 was lower than in preceding years due to a breakdown in April and to other shorter stoppages. In 2004 the mill will improve burning availability.

Reduced emissions to air

Appendix 3 details the emissions to air for the last five years.

To get a historical perspective of the emission of sulphur, measurements have been compiled for the period 1970-2000. Prior to 1976 emissions were calculated based on knowledge of the process. After 1976 you can find current measurements. Emissions have been reduced by approximately 95% during this period as a result of closing down antiquated parts of the mill and introducing the different purification measures mentioned.

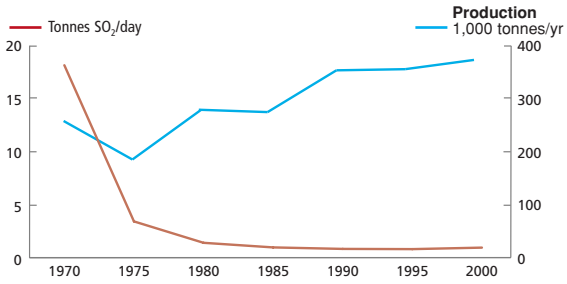
Emissions to air from transports

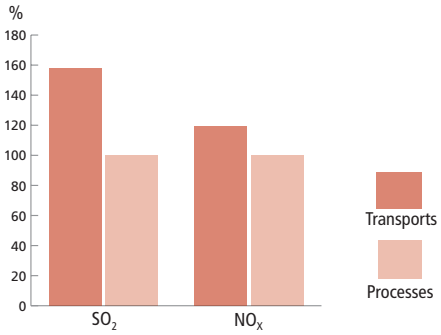
Deliveries of raw materials to the mill and shipping of pulp and paper from the mill account for most of the mill's transports.

The largest amounts come from the deliveries to the mill's customers. These emissions have been calculated. The diagrams show that emissions of sulphur dioxide (SO_2) from transports is around 60% higher than corresponding figures for production processes, while emissions of nitrogen oxides (NO_x) from transports are 20% higher.

Emissions from transports have risen compared with previous years, mainly because distances to customers have increased.

Emissions of sulphur dioxide (SO_2)





Sulphur dioxide (SO_2)

A gas consisting of sulphur and oxygen formed during combustion of sulphur-containing fuels such as black liquor and oil. In contact with damp air, sulphur dioxide is converted into sulphuric acid which causes acid rain.

Bark boiler

A boiler that burns mainly bark and other bio fuels to produce steam.

Nitrogen oxides (NO_x)

A group of gases composed of nitrogen and oxygen which are formed during combustion. In damp air, nitrogen oxides are converted to nitric acid which causes acid precipitation. Also have a fertilizing effect.

Scrubber

A device used for washing gas. A flow of liquid removes the particles and dissolved substances, e.g. sulphur dioxide, from the gas.

Environmental Observers

An environmental panel made of approximately 30 people living in the community was formed in March 1993. Members of the panel report such things as odour to the mill, thus providing the basis for change. The panel also provides information on other disturbances created by the mill. An annual meeting of the panel is held at which time the results are presented.

In 2003 there were 66 reports, four more than in 2002. This is still a low level compared with the 1990s. In 1996-98 there was almost double the number of reports. One of the reasons for the decrease in reports in the last few years is that the number of reports related to odour has decreased tremendously as a result of more effective purification of wastewater.

A second reason for the decrease in the number of reports is the new wood room (with silos) which has eliminated the problem of dust being blown about.

A new silencer was installed in 2003 on the vacuum pump outlet on PM9 in order to reduce noise levels for local residents.

Noise Reduction and Residual Products

Noise

Moving wood chips from the wood room to the digesters generates a lot of noise. Over the years major steps have been taken to reduce noise created by chip blowers, chip conduits and bulldozers.

The new wood room, which was put in operation in 2000, has led to lower noise levels from barking and cutting. The addition of silencers to a number of fans in the mill has resulted in reduction of noise.

In the sulphate mill the main steam safety valves are fitted with silencers. The results of noise measurements for the last five years are shown in Appendix 4 and the problems with approved weather conditions at the measuring point are explained.

Residual products

Residual products (waste) from the mill consist mainly of ashes from the bark boiler, bark mixed with gravel that cannot be burnt in the bark boiler, gravel and sludge from the recovery of chemicals, rejects from recycled corrugated board and heavy refuse.

These waste items are dumped at the mill's tip at Hyttemossen, around 1.5 km south of the mill.

Dumping of plastic waste from recycled corrugated board ended in 2003. This waste is now burnt by Linköping Municipality.

Hazardous waste, mainly waste oil, is sent to companies that have the correct waste disposal permit.

Environmental measures at the tip

The mill has a plan for handling residual products. Extensive sorting and recycling takes place to minimise the volume of waste sent to the tip. Investigating ways of reducing the amount of waste is an on-going programme.

The leachate from the tip is collected and pumped to the biological treatment plant. Areas that have been filled are replanted in agreement with the County Administrative Board and local residents.

The environmental impact assessment sent to the Licensing Board for Environment Protection in 1996 included an extensive report compiled by the Swedish Geotechnical Institute. The most important conclusions were:

- The leachate is pumped to the biological treatment plant for wastewater
- The level of metal concentration in the leachate is the same as that found in municipal landfills
- There are no signs of an effect on the groundwater downstream of the tip

Quantities of waste

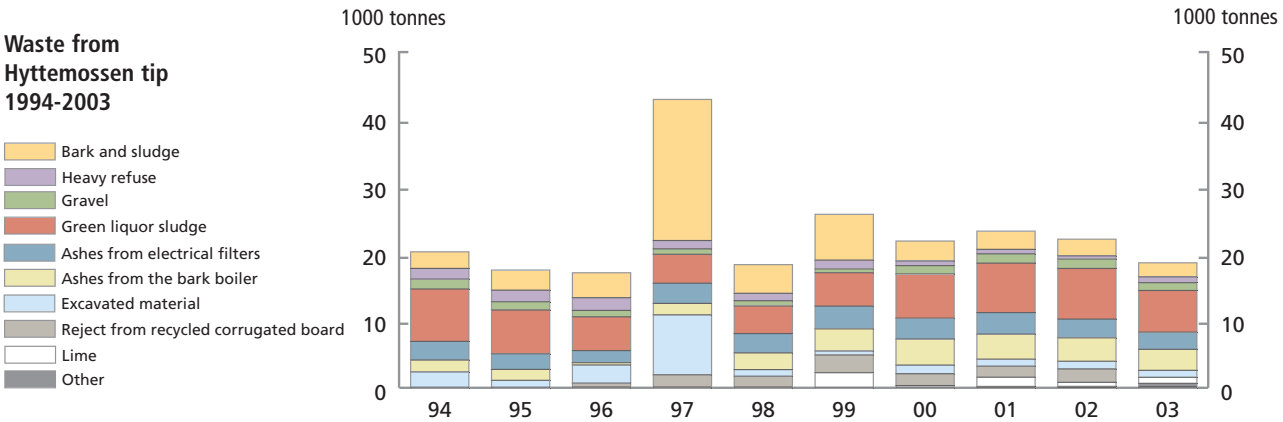
The graph on page 27 shows how the amount of waste sent to the tip has varied in the last ten years. In 1997 the amount of sludge from the aerated lagoon was greater than usual due to the dredging work which was required before the lagoon was rebuilt to increase its efficiency. More detailed figures for the past five years can be found in Appendix 5.

Landfill site
Landfill site that is equipped to handle waste products in a controlled fashion.

Leachate
The water, primarily rainwater, which comes from e.g. a tip

Dumping of plastic waste from recycled corrugated board ended in 2003. This waste is now burnt by Linköping Municipality. The pictures show waste being loaded for transportation to Linköping.

Waste from Hyttemossen tip 1994-2003



At the end of each year data is collected in an extensive environmental report that is sent to various authorities, including the county inspection authority.

« The Environmental Statement, which you are now reading, is a simplified version of the report.

Environmental Permit

On 18 July 1997 the mill received a new permit from the Licensing Board for Environment Protection. In accordance with this permit the production of market products may be increased gradually from 385,000 tonnes to 470,000 tonnes per annum.

In the permit the Licensing Board has accepted suggestions from the mill for a number of environmental improvements. A considerable sharpening of most of the emission conditions means that most of the environmental work has been concentrated on fulfilling these new conditions.

- The most important single improvement in wastewater treatment, the conversion of the aerated lagoon into a more efficient treatment plant, was completed in the autumn of 1998. The different emissions to water decreased considerably in 1999 as a result of this measure. There were also a number of internal process improvements to be implemented gradually to maintain the decreased level of emissions during the planned increase in production.
- A new wood room results in reductions in noise level, dust (from chip handling) and the emissions to water (completed early 2000).
- Improved cleaning of condensate will decrease emissions of COD. Has not been accomplished so far.

Condensate
Substances which when being cooled have condensed from gas to liquid form, e.g. steam which has condensed to water.

- Trimming and/or completion of the washers in the sulphate mill decreases emissions of COD (completed on one of the pulp lines 2001).
- Completion of the spill collecting system decreases emissions of COD.
- Modification of the bleaching process reduces chlorine dioxide consumption and emissions of AOX (has been completed).

A number of improvements are planned for the emissions to air. These are carried out in connection with the rebuilding of the boilers:

- A reduction of NO_x emissions from the recovery boiler and the bark boiler by redistribution of the combustion air (completed 1997 and 2000 respectively).
- Restoration and completion of the recovery boilers' electrical precipitators to decrease dust emissions to air. Has not been accomplished so far.
- A permanent NO_x reduction in the bark boiler by using ammonium compounds (carried out in 1997).

Work is also continuing on:

- Improvements to the landfill dump in the form of e.g. drainage, sealing, covering (currently being done)

On 28 November 2003 the Environmental Court of Appeal established the final conditions regarding diffuse sulphur and ammonia from the bark boiler. Previously, on 14 February 2003, the Environmental Court announced its verdict on the final conditions for phosphorous, process sulphur, nitrogen oxides and noise. These conditions were deferred probationary conditions from a previous verdict in 1997.

Environmental Work 2003

The focus of environmental work in 2003 was on adjusting the LAS plant to further reduce emissions of phosphorous to the River Motala and on various measures aimed at reducing emissions of nitrogen oxides (NO_X).

Water

Investments were made to improve external treatment of wastewater. A permanent installation for regulating phosphorous was constructed next to the LAS plant. This will be taken into operation during 2004. The aim is to improve sludge quality and thus reduce emissions and the amount of sludge sent for burning.

Four new surface aerators were acquired at the start of the year to increase aeration availability in the LAS plant. During the spring stoppage a new cleaning grate was installed before the pre-sedimentation stage. A sludge level gauge was installed in the mid-sedimentation stage in order to improve regulation of excess sludge.

Relatively large amounts of bio-sludge have accumulated in the cooling pond, mainly during the start-up of the LAS plant. The pond also contains lime from the previous aerated lagoon. During the summer phosphorous from the sludge sediment is released and emissions to the recipient are higher than normal. To ensure that the cooling pond work efficiently and to minimise future leaks of phosphorous, dredging of old sludge sediment continued in 2003.

The amount of dredging is limited by the fact that the bark boiler cannot burn sludge when it is too wet. During the spring and summer tests were carried out to dry the sludge using sun and air at Econova in Norrköping. These tests were not successful, mainly because of large amounts of rain. New tests will be made in 2004.

A stripper is used in the sulphate mill to clean turpentine waste from condensate. On some occasions the amount of turpentine has been relatively high in the condensate entering the stripper. This has resulted in turpentine remaining in the condensate reaching the LAS plant, which has disrupted the microbiology. Turpentine extraction was improved significantly in 2003 and no disruptions occurred in the second half of the year.

Air

The main focus in 2003 was on establishing stable levels of dust, well below the permit conditions, after the lime kilns. This was achieved by reducing lime sludge production and purchasing lime. An assessment will be made in 2004 of the measures required to meet permit conditions during normal production of lime sludge.

Improvements in mixing of sludge (from external treatment) with bark continued in 2003. This work achieves a more homogenous mix of the bio fuel, which makes operation of the bark boiler easier and thus helps reduce emissions of primarily NO_X.

Ammonia is injected into gases from the bark boiler in order to reduce NO_X emissions. New nozzles were installed in 2003 to achieve a more even distribution of ammoniac and thus further reduce NO_X emissions.

Finally, a new control system for the oil boiler was installed which will facilitate control of the boiler and reduce emissions of flue gases.

Noise

A new silencer was installed on a vacuum pump outlet on PM9.

Residual products (waste)

Up to 2002 plastic waste from recycled corrugated board was dumped as landfill. Starting in 2003 this waste was sent to Linköping Municipality for burning. A total of 2,800 tonnes of waste was used as fuel.

To reduce the smell of landfill waste a cover and drain was installed for the dike system.

A project involving NCC, Gjuteriföreningen and Chalmers continued in 2003. The aim of the project is to find uses for waste products. The mill's involvement concerns bottom ash from the bark boiler. An assessment is being made of using the ash as filler when building roads, including the environmental impact. The project is expected to be concluded in 2004.

Strategic objective

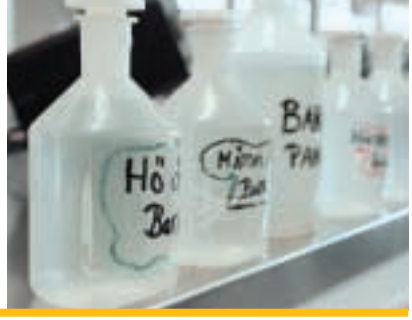
Skärblacka Mill will, not later than 2005, fulfil all the requirements of the Licensing Board, i.e. the mill will have been rebuilt in accordance with the decision.

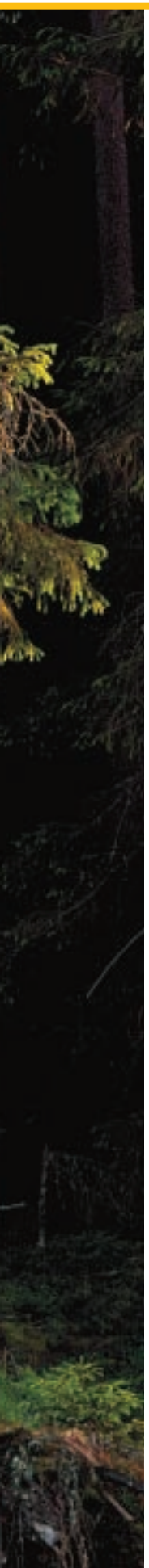
Long-term objectives

Noise
The number of reported complaints concerning noise in 2004 will be half the level of 2001.

Solid waste
No lime sludge will be dumped as landfill in 2005.

Water consumption
In 2005 the amount of water consumed will not exceed 4 100 m^3/h.





Environmental Objectives and Environmental Programme

The mill's management team has laid down strategic and long-term environmental objectives that form an important foundation for the setting of annual objectives. The strategic objective is based on the permit, dating from 1997, which states that approved production levels and related environmental measures shall be completed before the end of 2005. Should these levels not be met the permit expires for the parts not fulfilled.

Comprehensive objectives for 2003

Based on the strategic and long-term objectives the management team has decided which comprehensive objectives applied in 2003. These objectives were broken down into departmental targets as suitable. In addition to measures necessary to achieve the quantifiable objectives, a number of measures were implemented where it is difficult to measure the exact effect on the environment. Furthermore, investigations were made where the results would serve as the basis for future environmental measures.

A follow-up of objectives is carried out four times a year and in the event of discrepancies a decision is taken regarding corrective action. The comprehensive objectives for 2003 and the results of follow-up are shown below.

Quantifiable environmental objectives	**Follow-up**	
Take action in 2003 regarding the intermittent sources of noise so that the number of complaints about noise in 2004 will be half the number reported in 2001.	4 complaints about noise in 2003 (8 in 2001). Silencer fitted in vacuum pump outlet on PM9.	
Resource consumption		
• Reduce specific oil consumption calculated per tonne of market products by 4% compared with 2002, excluding oil for backpressure power.	25% reduction.	
• At the sulphate mill a target was set that 1 MW of electricity would be disconnected by the end of the year.	184 kW disconnected.	*)
Measures and investigations	**Follow-up**	
Solid waste		
• AIS project 32 started in 2002 to find alternatives to landfill disposal of bottom ash. Project completed in 2003.	Work proceeding according to plan.	
• Investigate alternative uses of lime sludge than re-use in the process or landfill. Objective that no lime sludge dumped as landfill from 2005.	Project under way regarding treatment of dust after lime kilns.	
Water consumption		
• Reduced water requirement in the bleaching plant.	Surveys completed that indicate opportunities for reducing water consumption.	
• Retain or reduce water requirement for PM9 despite production increase.		
Consumption of resources		
• Increase opportunities for saving energy by introducing a monitoring system to be fully operational during 2004.	Monitoring system has been selected and is being installed. Proceeding according to plan.	

Notes

*) The purpose of the objective is to focus on unnecessary effects and is also linked to investments. The result was much lower than expected but is nevertheless acceptable.

Comprehensive objectives for 2004

The management team set the following objectives for 2004.

Quantifiable objectives

Noise
- Take action regarding the intermittent sources of noise so that the number of complaints about noise in 2004 will be half the number reported in 2001.

Energy
- Specific steam consumption per tonne of product, calculated as annual average, will not exceed:

  - TM 1 3.1 GJ/tonne, calculated exclusively as air borne dried.
  - PM 4 5.8 GJ/tonne
  - PM 7 4.3 GJ/tonne
  - PM 9 5.6 GJ/tonne

The corresponding values in 2003 as a comparison:

  - TM 1 3.3 GJ/tonne, calculated exclusively as air borne dried.
  - PM 4 5.8 GJ/tonne
  - PM 7 4.5 GJ/tonne
  - PM 9 5.8 GJ/tonne

A relatively great improvement was accomplished in 2003 regarding the specific steam consumption at PM 4. The objective for 2004 is to maintain the new lower level.

Measures and investigations

Solid waste
- Perform AIS project 32 in 2004 to find alternatives to landfill disposal of bottom ash. Project completed in 2004.
- Investigate alternative uses of lime sludge than re-use in the process or landfill. Objective that no lime sludge dumped as landfill in 2005. Included in project for dust treatment at lime kilns.

Reduced water consumption
- To be managed as project. Action plan for 2004 to be produced.

Energy
- Introduce monitoring system to be in full operation during 2004.

A follow-up of objectives, measures and investigations is done four times a year. The results will be published in the Environmental Report for 2004.

Audit

Det Norske Veritas AB (DNV) is an environmental controller accredited by SWEDAC (accreditation number 1053) according to EMAS.

DNV has examined Billerud Skärblacka AB, in Skärblacka, and has stated that the company has an environmental management system fulfilling the demands in the EMAS-regulation (No. 761/2001).

DNV has also examined the Swedish version of the environmental report and found it correct and sufficiently detailed to fulfil the requirements in EMAS.

Appendices with data for the period 1999-2003

Comments on information provided in appendices

The conditions of the Licensing Board for Environment Protection are often expressed in terms of quantity per year or per day and this can be measured with a high degree of accuracy. In order to simplify a comparison of these demands, most figures relating to production, consumption and emissions have been expressed in this way.

Calculating emissions in kilos per tonne product is, for most types of emissions to water, decidedly more difficult. Based on the process descriptions, it is obvious that the mill has several different production lines producing a variety of products. The total emissions from the mill are measured in kilos or tonnes per day after the common wastewater treatment. Any attempt to calculate emissions in kilos per tonne product, based on total emissions, would provide uncertain results. Similar problems also arise related to emissions to air.

In some cases there is a certain type of emission from only one production department and from one type of product and it is simple to do calculations in kilos per tonne. Two examples of this are AOX to water and chlorine/chlorine dioxide to air, both of which come from the bleaching plant. These demands are expressed in kilos per tonne bleached pulp.

As it relates to emissions to air, certain measurements are expressed in kg/tonnes and others in mg/cu.m flue gas or in percentage of excess time at certain concentration levels.

From February 2003 the Environmental Court decided to set conditions for emissions of phosphorous to water. A number of new conditions for emissions to air were also set in 2003. All emissions covered by conditions are indicated in the graphs in Appendix 2.

Appendix 1

Production, consumption

Production		1999	2000	2001	2002	2003
Pulp						
Unbleached sulphate pulp	tonnes/year	281 500	308 500	310 400	322 000	328 000
(of which is bleached)	tonnes/year	143 300	156 300	159 300	163 000	164 000
Semi-chemical pulp	tonnes/year	57 100	58 200	58 700	60 000	62 000
Market products						
Paper and market pulp	tonnes/year	350 000	378 000	380 000	392 000	401 000

The amount of market products produced is net production, i.e. the amount ready for delivery to the customer. The production increase over five years is due to several small investments aimed at raising production and to fewer disruptions.

Raw material consumption		1999	2000	2001	2002	2003
Water intake	cu.m/day	86 000	90 400	95 200	97 900	96 400
Softwood	sm^3ub*/year	852 900	965 000	1 012 700	1 042 300	1 087 500
Hardwood	sm^3ub*/year	391 800	396 000	379 800	382 100	394 200
Corrugated waste paper	tonnes/year	32 600	40 500	38 000	40 300	31 000
Bulk chemicals	tonnes/year	35 500	38 400	38 000	37 900	36 500
Additives	tonnes/year	10 600	10 800	9 900	10 400	10 900

Raw material consumption is in relation to production levels. Around 8% of wood was imported in 2003. "Bulk chemicals" refers to standard chemicals used in fairly large quantities in production. "Additives" are chemicals used to give the products certain properties or to make production easier or to reduce disturbances.

*) solid measure under bark.

Energy consumption		1999	2000	2001	2002	2003
Light fuel oil	m^3/year	184	110	78	17	68
Heavy fuel oil	m^3/year	41 600	33 800	28 100	26 600	24 900
Pine oil pitch	m^3/year	0	2 200	10 500	11 500	13 600
LP gas	tonnes/year	2 400	2 700	2 700	2 800	2 700
Wood fuel	tonnes/year	52 200	51 800	60 300	55 300	52 300
Electricity (purchased)	GWh/year	371	386	377	398	381
Electricity (own production)	GWh/year	95	92	93	88	113

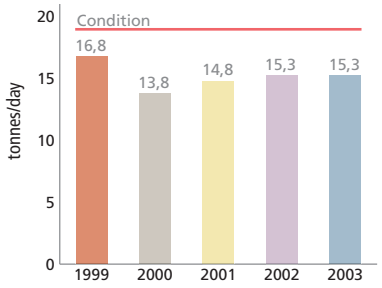
Oil consumption in 2003 was somewhat lower than the previous year.

Appendix 2

Emissions to Water

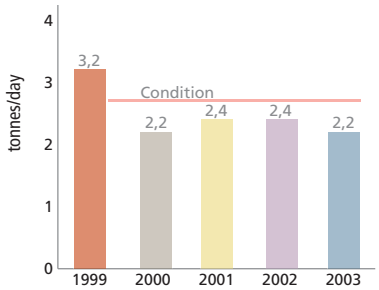
Emissions of COD to water

From 1999 the condition was reduced to 19 tonnes/day. Over a five-year period the emissions level has been relatively stable at around 15 tonnes/day. The condition has been met with a good margin.



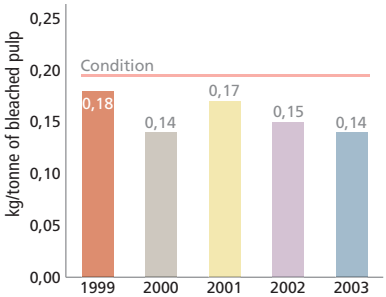
Emissions of SS to water

From 1999 the condition was reduced to 2.7 tonnes/day. This annual target value was not entirely achieved in 1999 because the trimming of the biological treatment plant was not completed until the autumn of 1999. The condition was met with a good margin in 2000-2003.



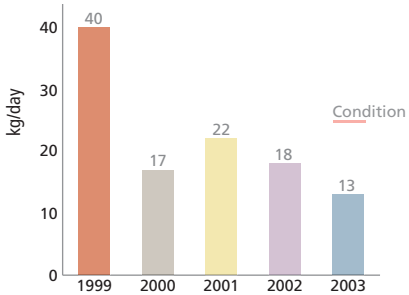
Emissions of AOX to water

The graph on page 21 shows that the emissions of AOX in tonnes/day has been reduced considerably since 1985 due to oxygen bleaching and elemental chlorine-free bleaching. In the adjacent diagram emissions are expressed, as they are in the condition, as kg/tonne of bleached pulp. The condition was lowered to 0.2 kg/tonne from 1999, which has been fulfilled thanks to efficient biological treatment.



Emissions of phosphorous to water

From February 2003 the condition for emissions of phosphorous is 25 kg/day. The condition has been met with a good margin.



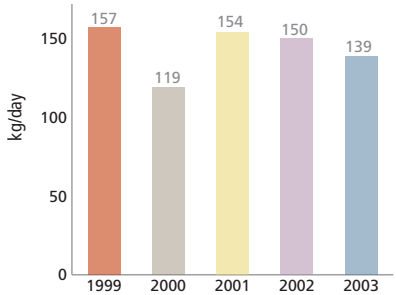
Appendix 2

Emissions to Water

The mill has a modern and well-equipped laboratory that measures emissions to air and water.
The laboratory is accredited with a government authority, which means that strict requirements must be met concerning competence and quality. The picture shows equipment for analysing metals.

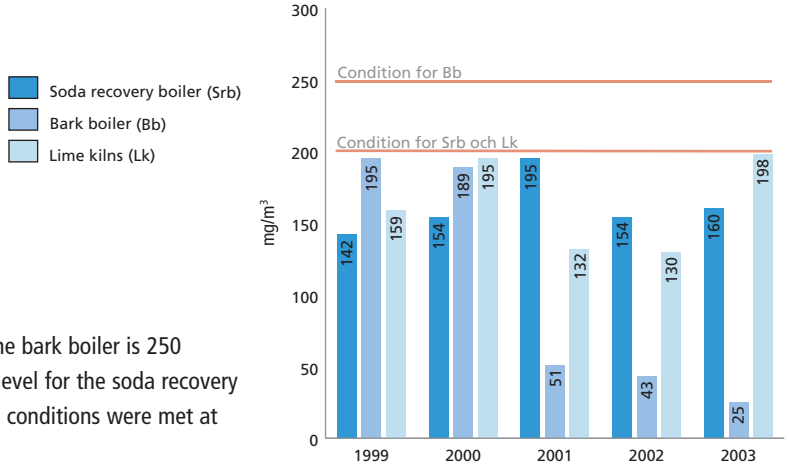
Emissions of nitrogen to water

The emissions level is relatively constant at between 120-150 kg/day.



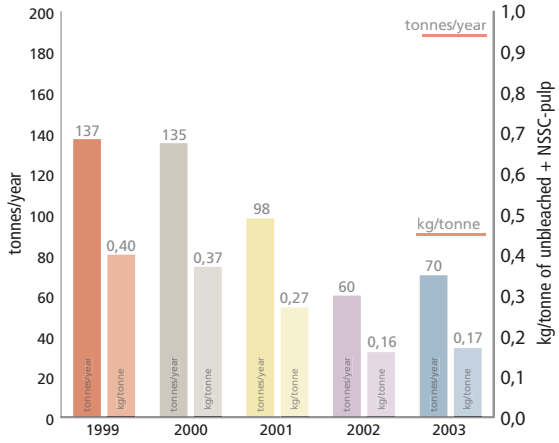
Appendix 3

Emissions to Air



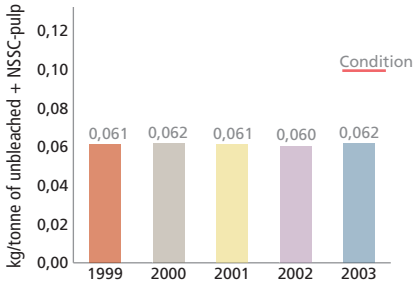
Emissions of dust to air

The maximum emission of dust from the bark boiler is 250 mg/m3 of flue gas. The corresponding level for the soda recovery boiler and lime kilns is 200 mg/m^3. The conditions were met at all positions throughout the period.



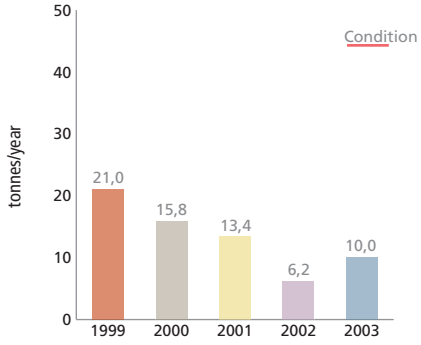
Emissions of process sulphur

New conditions for process sulphur were set from February 2003. One condition is expressed as tonnes/year while the other condition is specific and formulated as kg/tonne of unbleached pulp and NSSC pulp. Both conditions were met with good margins in 2003.



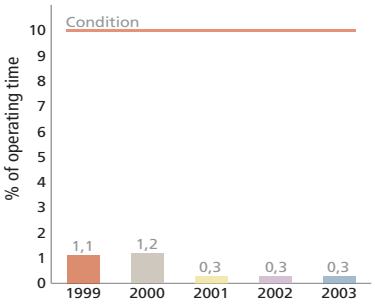
Emissions of diffuse sulphur

A new condition set in December 2003 to cover gases from the NSSC mill and from cisterns not connected to the odour destruction system. The condition was met with a good margin in 2003.



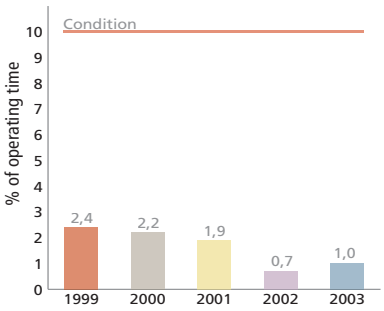
Emissions of energy sulphur

A new condition set in February 2003 to cover sulphur emissions from energy production in the bark boiler and oil boiler. The condition was met with a good margin in 2003.



Exceeding 10 mg H_2S/m^3 in flue gases from the soda recovery boiler

Emissions of hydrogen sulphide from the recovery boiler may exceed 10 mg/m³ not more than 10% of operating time. As is the case with the lime kilns, the results vary from year to year but are well within the condition.

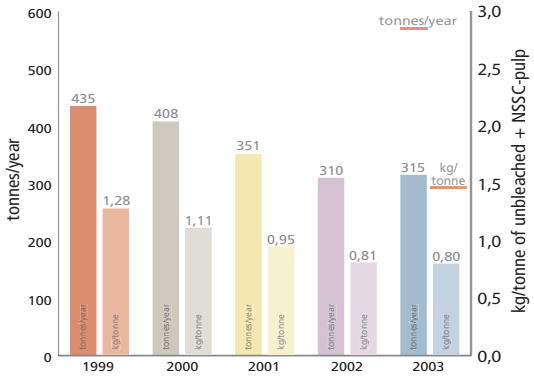


Exceeding 50 mg H_2S/m^3 in flue gases from the lime kilns

Emissions of hydrogen sulphide from the lime kilns may exceed 50 mg/m³ not more than 10% of operating time. The results vary from year to year but are well within the condition.

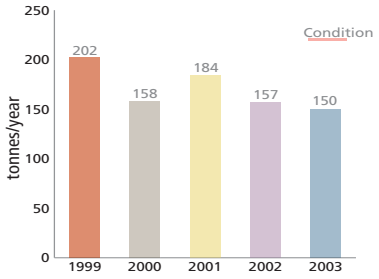
Emissions of process NO_x

New conditions for process NO_x from February 2003. One condition is expressed as tonnes/year while the other condition is specific and formulated as kg/tonne of unbleached pulp and NSSC pulp. Both conditions were met with good margins in 2003.



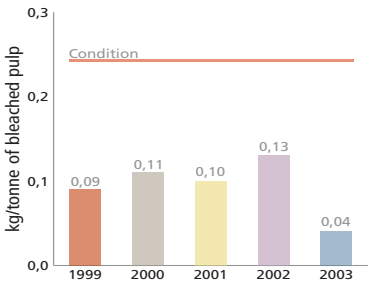
Emissions of energy NO_x

New conditions from February 2003 cover emissions of NO_x from energy production in the bark boiler and oil boiler. The conditions were met with good margins in 2003.



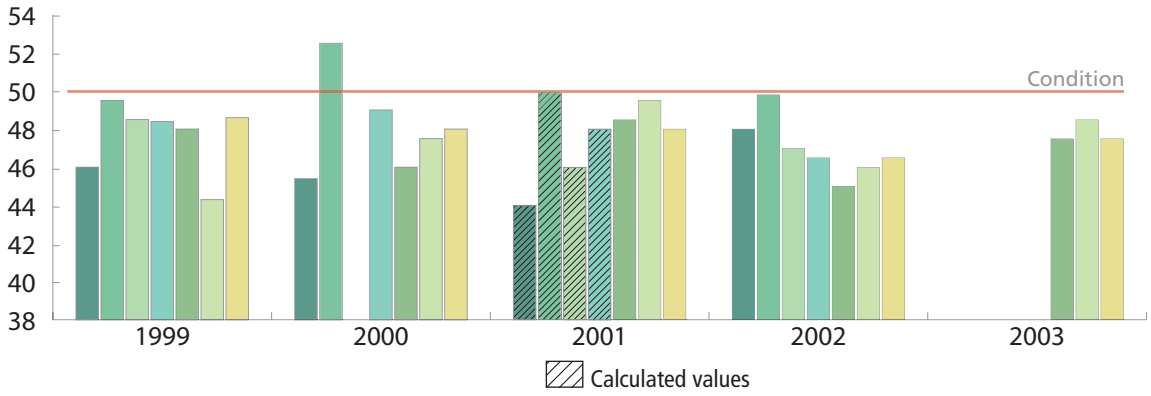
Emissions of chlorine/chlorine dioxide to air

The condition, 0.25 kg/tonne of bleached pulp, was met with a good margin throughout the period.



Appendix 4

Noise levels



External noise at night at 7 measuring positions

Measuring position 8 for noise is at a school where the maximum level during daytime is 55 dBA. Measurements taken in the past few years have been at or below this level. The other seven positions are in housing areas where the limits at night, between 10.00 p.m. and 6.00 a.m., are 50 dBA.

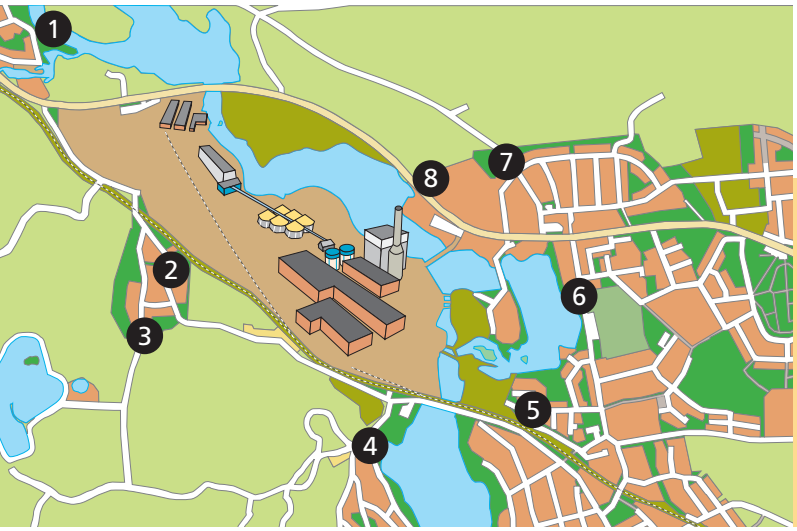
The bar chart shows the annual average at night in each of the seven positions between 1999 and 2003. In 2000 the noise level was 52.5 dBA at measuring position 2. A plan of action was approved by the County Administrative Board and was set in motion at the beginning of 2001 in order to ensure a noise level not higher than 50 dBA, even at measuring position 2.

In 2001 measurements have been taken of noise levels at night at four of the eight measuring positions outside the mill area. The Swedish Environment Protection Board stipulates that measurements of noise levels must be taken with winds of between 2 and 5 m/s from the noise source. There are also other demands, for example that there may not be an inversion in the air. As a result of these demands, it can be difficult to have the right weather conditions for measurements to be taken at certain measuring positions.

At measuring positions 1-4, it was not possible to take measurements in 2001 as a result of bad weather conditions. The noise consultant, Ingemansson Technology, calculated noise levels at positions 1-4 to be 44, 50, 46 and 48 dBA, respectively. Discussions are being held with the County Administrative Board about whether and how changes can be made to reduce dependence on weather conditions.

In 2002 it was possible to take measurements at all positions and it was confirmed that the results were within the conditions set.

In 2003 there were again problems in obtaining the correct weather conditions for measurements at positions 1-4. In 2004 the mill will work with Ingemansson Technology to investigate alternative methods for checking noise levels.



1. Strömvägen
2. Solstigen
3. Västanvägen 10
4. Sundvägen
5. G:a Bruksvägen/ Ekuddevägen
6. Stationsvägen 10
7. Mosstorpsvägen/ Ribbingsholmsvägen
8. Mosstorpsvägen 10

Appendix 5

Solid Waste

Solid waste for disposal		1999	2000	2001	2002	2003
Bark and fibre sludge	tonnes/yr.	6 831	2 959	2 783	2 474	2 083
Heavy refuse	tonnes/yr.	1 306	707	675	476	877
Lime grit	tonnes/yr.	575	1 241	1 385	1 418	1 167
Green liquor sludge	tonnes/yr.	4 963	6 564	7 348	7 527	6 199
Ash from electrical filters	tonnes/yr.	3 384	3 185	3 199	2 789	2 556
Ash from bark boiler	tonnes/yr.	3 289	3 872	3 720	3 480	3 125
Excavation and covering material	tonnes/yr.	590	1 282	1 040	1 140	1 034
Rejects from corrugated paper board	tonnes/yr.	2 641	1 763	1 640	1 990	0
Lime sludge	tonnes/yr.	2 245	0	1 370	605	909
Cleaning at stoppage	tonnes/yr.	0	333	200	214	662
Total	tonnes/yr.	25 824	21 906	23 360	22 113	18 612

In 1999 the amount of waste increased somewhat compared to the previous year. The increase was primarily bark and ashes and lime sludge. One reason was the building of a new wood room and during the time of reconstruction the dry solid content of bark was so low that it could not be burnt. One of the lime kilns broke down in December, and the result was that lime sludge had to be disposed of.

The amount of bark to be disposed of decreased in 2000 as a result of the new wood room. Improved sorting also resulted in a reduction of heavy refuse. In 2001 the amount of waste to the landfill was approximately 1500 tonnes higher than in 2000. 1400 tonnes of this was lime sludge which needed to be disposed of after several break-downs of lime kilns.

In 2002 the amount of waste sent as landfill was around 1,200 tonnes lower than in 2001. Around half of this reduction was due to lower amounts of lime sludge sent as landfill.

The amount of waste sent as landfill was reduced further in 2003. Plastic rejects from recycled corrugated board is now burnt by Linköping Municipality. The amount of green liquor sludge has also been reduced significantly.
Hazardous waste, consisting mainly of oil and grease containing water, amounted to 200 tonnes in 2003, which is a normal level.

Appendix 6

Occasional emissions in 2003

The environmental management system contains a procedure for reporting non-conformity. Small, occasional emissions and incidents (when an accident nearly occurred) must be reported internally to prevent future emissions. Most of these incidents are not significant enough to be reported to the County Administrative Board. The following emissions in 2003 have been commented upon in the monthly environmental reports or in separate reports submitted to the County Administrative Board.

Date	Emissions	Measures	Report
3-9 Jan	Brief stoppage of wastewater pumps in pump station. Small amount that spread.	Replacement of faulty circuit board. New control system installed during 2003 spring stoppage. Large rebuild of pump station during 2004 spring stoppage.	Reported by mail to County Administrative Board and in monthly report.
11 August	Fire at bark boiler resulted in emissions of hydraulic oil into river. Hard to judge amount, but not large.	C drain closed off. Boom deployed over river.	Reported by telephone and mail to County Administrative Board. Local water company informed by telephone.
23 Sept	Disruption to wastewater pump in connection with major power cut in southern Sweden. Small effect on emission levels.	Whole mill closed down so wastewater flows became minimal. Measures in LAS plant to ensure efficient start-up. Minimal rise in emission levels in days after stoppage.	Reported by mail and telephone to County Administrative Board and in monthly report.
2 Nov	Emission of impure condensate (max. 100 litres) via C drain into river. Small effect on emission levels.	Preventive measure in the form of cleaning of one cistern. The level for an alarm was reduced to provide more time to implement measures that can prevent a reoccurrence.	Reported by mail to County Administrative Board.
6 Nov	Emission of primary condensate containing liquor via C drain into river. No effect on emission levels.	Faulty pre-heater replaced. During 2004 spring stoppage a rebuild will ensure that emissions go to the external treatment plant if this incident happens again.	Reported by mail and telephone to County Administrative Board and in monthly report.
13 Nov	Sealing water, directed to C drain, contaminated with black liquor. Small effect on emission levels.	C drain closed off. Threshold raised to reduce risk that an overflow can reach C drain again.	Reported by mail to County Administrative Board.

Appendix 7
Glossary

Aerated lagoon
Biological treatment method which reduces the BOD, COD and AOX content of effluent.

AOX
Collective term for the quantity of chlorine bound in organic compounds. It is formed during bleaching of pulp with chlorinated chemicals, but is also formed naturally.

Bark steam boiler
A boiler that burns mainly bark and other bio fuels to produce steam.

Bio fuels
Renewable fuels originating from the plant kingdom, for example from wood, including black liquor and bark.

Black liquor
The name given to the consumed cooking liquid in production of sulphate pulp. Black liquor is burnt in the soda recovery boiler at which time the wood substances (primarily lignin) provide energy for steam and electricity production. One requirement for both the environment and economy is that the chemicals consumed in black liquor are reproduced in the sulphate mill to new cooking chemicals.

Bleaching
Chemical process used to produce a pure bright (white) and stable pulp. In Skärblacka environmentally adapted ECF-bleaching is used without chlorine gas.

BOD (Biochemical Oxygen Demand)
Biochemical oxygen demand is a measure of the amount of oxygen that is used by micro-organisms in 7 days' decomposition of the emission.

COD (Chemical Oxygen Demand)
A measure of the amount of oxygen needed to complete oxidation of organic matter in water.

Condensate
Substances which, when being cooled, have condensed from gas to liquid form, e.g. steam which has condensed to water.

Corrugated board
Corrugated board is manufactured by gluing two flat layers of paper (liner) with a rippled layer (fluting) in the middle.

ECF-bleaching (Elementary Chlorine-Free)
A method where pulp is bleached using chlorine dioxide and peroxide instead of chlorine gas.

EMAS (Eco Management and Audit Scheme)
The EU's environmental management and environmental audit regulation.

Emission
Discharge of substances to air, land and or water.

Environmental aspects
Emissions from the mill and consumption of resources by the mill.

Environmental impact description
Investigation of the impact a special operation has on the environment.

Evaporate
Using heat, the dry content of e.g. black liquor, is increased by removal of water and other volatile substances.

Fluting
The rippled middle layer in corrugated board, produced from either new or recycled fibre.

Fossil fuels
Fuels based on organic carbon and hydrogen compounds deposited in sediments or rock deposits – mainly coal, oil and fossil gas.

Hardwood
Normally birch. Hardwood has shorter fibres than softwood. The most important ingredient in fluting as well as writing and printing paper.

ISO14001
The International Organisation for Standardisation ISO's standard for an environmental management system.

Landfill
Landfill site that is handled in a controlled fashion.

Leachate
The water (primarily rainwater) which leaks out from, e.g. a tip.

Lignin
Wood substance that makes up about 30% of the total wood content. Lignin is dissolved in the cooking process in pulp-making and is burnt together with dissolved carbohydrates as bio fuel (black liquor) in the soda recovery boiler for energy production.

Lime kiln
Important part of sulphate pulp mill's chemical recovery system. Lime sludge (calcium carbonate) is burnt in this kiln to produce lime.

Market pulp
Pulp which is sold to paper mills.

MG Paper (Mono Glazed Paper)
Paper which is dried on a highly polished Yankee cylinder thus producing paper which has a very smooth, glossy surface on one side. Used for packaging with strict hygiene requirements.

Monitoring programme
A document that describes which check should be performed in order to ensure that the emissions conditions and other legal requirements are met.

Nitrogen (N)
A chemical element naturally present in wood. Discharges of nitrogen to water can cause nutrient enrichment, leading to luxuriant plant growth and subsequent oxygen deficiency when the plants decompose – a process called eutrophication.

Nitrogen oxides (NO_x)
A group of gases composed of nitrogen and oxygen which are formed during combustion. In damp air, nitrogen oxides are converted to nitric acid, which causes acid precipitation. Also has a fertilising effect.

Phosphorous (P)
A chemical element naturally present in wood. Discharges to water can cause nutrient enrichment, leading to luxuriant plant growth and subsequent oxygen deficiency when the plants decompose – a process called eutrophication.

Recipient
The part of the environment near a plant, e.g. air and water, which receives emissions.

Recycled fibre
Fibre material that has previously been used in a paper or board product.

Sack paper
Paper with high strength properties and used for the production of sacks. Made from softwood sulphate pulp.

Scrubber
Device used to wash gases. A flow of liquid removes particles, and dissolved substances, e.g. SO_2, from gases.

Semi-chemical pulp
Pulp where the fibres are separated through a combination of chemical and mechanical processing (defibration).

Soda recovery boiler
A steam boiler with a chemical reactor at the bottom. The organic matter in the black liquor (wood residues) is burnt at a very high temperature. Steam is generated while the organic material forms a melt at the bottom of the boiler from which cooking chemicals are recovered.

Softwood
Wood from coniferous trees, pine and spruce. Has longer and stronger fibres than hardwood. The most important raw material for strong paper.

Sulphate pulp
Chemical pulp produced by cooking wood under high pressure and at a high temperature in cooking liquor, known as white liquor (sodium hydroxide and sodium sulphide). Sulphate pulp is also known as kraft pulp.

Sulphur dioxide (SO_2)
A gas consisting of sulphur and oxygen formed during combustion of sulphur-containing fuels such as black liquor and oil. In contact with damp air, sulphur dioxide is converted into sulphuric acid which causes acid precipitation.

Suspended solids (SS)
Substances suspended in water consisting of fibres and other particles that can be separated with a filter.

The Licensing Board for Environment Protection
A licensing authority, giving environmental permits to big factories, for example pulp and paper mills. From 1999 the Licensing Board has been replaced by Environmental Courts.

White liquor
The name given to the cooking liquid which is used in production of sulphate pulp. It contains sodium hydroxide and sodium sulphide.

Wood room
The section of a pulp and paper mill where the incoming logs are debarked and chipped prior to cooking.

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