Environmental Report 2002

Nordkalk

Our aim is sustainable development

The new filter at the Louhi plant in Finland reduces dust emissions in an effective way.

The main principles of Nordkalk's environmental policy

Values and aims
- sustainable development
- compliance with environmental legislation and regulations
- identification of environmental impact of operations
- information about development, measures and results

Continuous improvement
- environmental impact taken into account when developing products and processes
- environmental plans form part of strategic planning and cover environmental aspects, aims and measures
- investment plans include an evaluation of the environmental impact of the investment
- environmental work is audited on a regular basis

Nordkalk extracts and refines limestone. The impact on the environment of these activities is monitored and evaluated on a continuous basis in accordance with the Nordkalk Group's environmental policy. This report provides an account of how our operations affect the environment together with the measures that have been taken or are planned to reduce any adverse effects.

Nordkalk aims at sustainable development, and the environmental implications of this are taken into account when the company sets up its strategic aims. Nordkalk endeavours to develop its products and processes in order to keep the environmental impact of its extraction and refining operations to a minimum. Careful and diverse monitoring leads to an increased awareness of environmental matters; in order to achieve sustainable development improvements are necessary all the time. All Nordkalk's production plants in Finland and its entire operations in Sweden have been certified according to the ISO 14001 environmental standard, which ensures continuous improvements in environmental matters. Nordkalk's environmental plans form part of the company's annual and strategic planning, and environmental measures are followed up continuously by means of regular audits. Responsibility for production-related environmental matters lies with the division managers while an environmental director supervises Nordkalk's environmental policy to ensure that it is complied with throughout the company.

In addition to the environmental measures taken in production, Nordkalk also participates in environmental training programmes for its customers. When drawing up contracts with entrepreneurs and sub-contractors Nordkalk requires that its environmental demands will also be met. The sub-contractors are checked regularly in this connection by means of environmental audits.

Nordkalk operates at various locations around the Baltic Sea, and the company tries actively to reduce its own emissions and effluents. Nordkalk is involved in many research and development projects that aim to improve the state of the environment. The recycling and disposal of carbon dioxide is just an example of how Nordkalk works with several Finnish research institutions in this respect. Another is the liming of the Alinen watercourse at Nokia to improve the quality of the water. Nordkalk also participates in the Pro Saaristomeri (Pro Archipelago Sea) project, the aim of which is to improve the quality of the archipelago seawater.

Environmental impact

Most of Nordkalk's production plants are situated in towns and built-up areas, which means that the surroundings place great demands on operations. Nordkalk extracts and refines limestone at 30 locations in Finland, Sweden, Estonia and Poland.

Some of the production units - such as Storugns on the island of Gotland, Sweden, and Miedzanka and Wolica in Poland - lie close to nature reserves. At Vimpeli the quarries border on an area that is subject to different preservation orders. The Lappeenranta industrial site is situated within a water preservation area, which increases the authorities' demands.

The most significant local environmental aspects of Nordkalk's operations are noise, vibration and dust. The burning of limestone causes flue gas emissions worldwide. Other disadvantages in conjunction with extraction include surplus stone, various waste materials from the production processes, and environmentally hazardous waste. The last consists primarily of different waste oils that are collected and treated in accordance with legislation and environmental regulations. The refining plants for wollastonite and calcite at Lappeenranta use large quantities of recirculated water.

Production processes

Limestone is extracted from the bedrock in either quarries or underground mines. The rock is transported for rough handling and sorting, after which it goes on to be processed further elsewhere. These operations give rise to vibration, noise and dust. Quarrying results in very obvious changes in the landscape. In addition to the stone that is actually used by Nordkalk, considerable amounts of surplus stone are also produced. To some extent this can be used as for macadam but part of it has to be stored in the vicinity of the quarry. Ground water seeps by way of cracks in the bedrock into the mines, and surface water collects in the quarries. This may affect the level of the ground water in the area.

Quicklime is produced by heating crushed and sorted limestone to a temperature of some 1000 °C in either a rotary or shaft kiln. The limestone ($CaCO_3$) decomposes into calcium oxide or quick-lime (CaO) and carbon dioxide (CO_2). Coal, oil or gas may be used to fuel the process. Quicklime is grainy or floury in appearance. It is sifted into different fractions or ground to a fine flour. Flue gases contain oxides of nitrogen (NO_x), carbon dioxide (CO_2) and varying amounts of sulphur dioxide (SO_2). The manufacturing process also releases dust into the air and to reduce this the flue gases are passed through an electric or fabric filter. Filter dust can be used as an agent for soil improvement. There are no discharges into watercourses from the lime burning process.

Quicklime products are used in the manufacture of iron and steel, for enriching sulphite ores, for pulp making and cleaning water, etc. Quicklime is also used in coal-fired power plants for cleaning flue gases.

Slaked, or hydrated, lime is made by adding water to quick-lime. The calcium oxide reacts with the water to produce calcium hydroxide ($Ca(OH)_2$). The slaked lime is a dry, powder-like flour light in colour. The process of slaking lime releases heat and steam. Efficient dust removal, however, means that the quantity of particles discharged into the atmosphere is negligible.

Slaked lime is used in communal and industrial water purification plants, for cleaning flue gases and as a building material.

Carbonate products consist of limestone, i.e. calcium carbonate ($CaCO_3$), which is crushed, ground and sifted. The grinding of the limestone is a dry process so that dust formation is a major environmental problem in plants where limestone is ground. The dust emissions are kept to a minimum by fabric filters.

The products are used for soil improvement, for cleaning flue gases at power plants and raising the alkaline level in water. It is also commonly used in animal feeds and as a filler in asphalt, paper and plastics.

Nordkalk **refines** calcite and wollastonite from the raw stone extracted from the mine at Lappeenranta. The refined calcite is then further processed to paper pigment. The water used in the closed refining process is mainly water from the mine. If necessary, water can be discharged under controlled conditions into a nearby ditch to which diverts also water from the local water treatment plant.

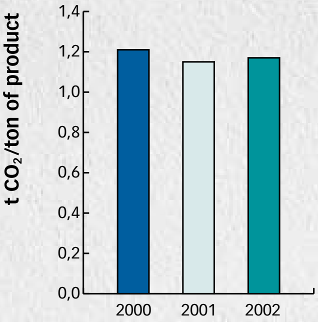
Energy consumption

The process of crushing, grinding and sifting carbonate products consumes electricity. Moreover, liquid gas or fuel oil is used for drying carbonate products. The specific consumption of energy in 2002 was 0.26 GJ per ton carbonate product. The specific consumption of energy has increased in recent years as a result of new ranges of products for which more energy is required than before. Energy analyses have identified potential ways of saving energy in the manufacture of carbonate products. These include, for example, changing the air intakes for the drums used to dry the products and reducing the temperature at certain stages of the process. Daily maintenance routines and careful regulation can also affect the consumption of energy, of course.

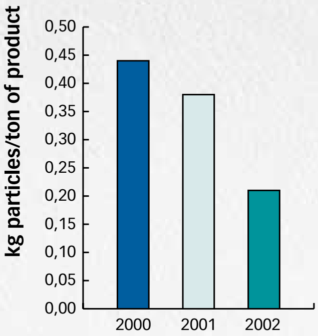
The process of burning lime requires high temperatures. Calcination of the limestone takes place in the kilns at a temperature of about 1000 °C. The heat comes from coal, fuel oil or coke gas. Coke gas is a by-product from the steel-making industry and can be used as a fuel in lime kilns if they are situated in the immediate vicinity of a steel factory. The use of other fuels to replace coal and oil in the lime industry poses a problem. The impurities in the fuels permeate the lime products, the purity demands for which are extremely strict. Moreover, the thermal values for substitute fuels are in general low so that the quantities of fuel required increase and necessitate major changes in the processes. The specific energy in the production of quicklime has dropped since the end of the 1990's and in 2002 it was 5.6 GJ per tonne of lime. The strong positive trend that took place in the years between 1996 and 1999 is explained by the increased capacity of fuel-efficient shaft kilns and completely new kilns. In the last four years the variations in the specific energy consumed can be explained by variations in the capacity of different kilns.

Specific Emissions in Air

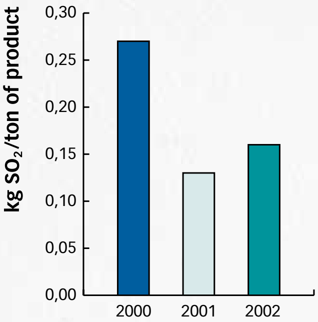
Quicklime



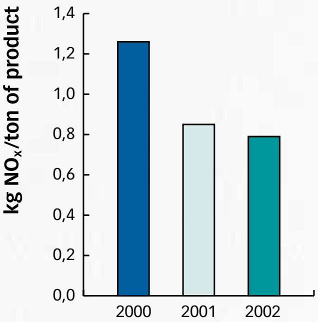
CO_2 specific emissions



emission of particles

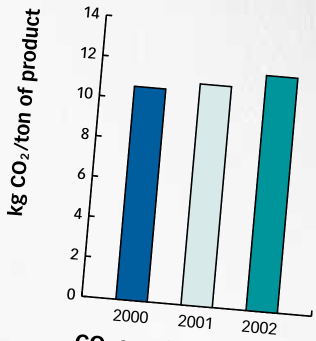


SO_2 specific emissions

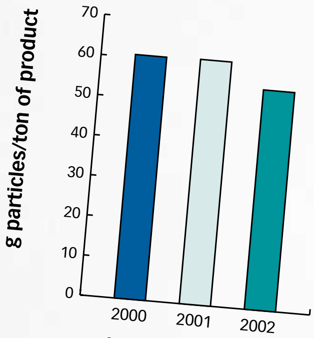


NO_x specific emissions

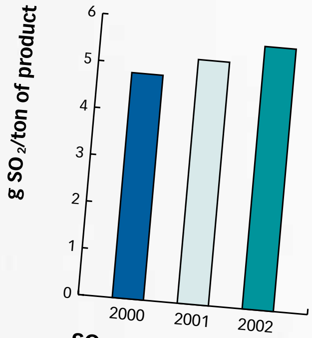
Carbonate products



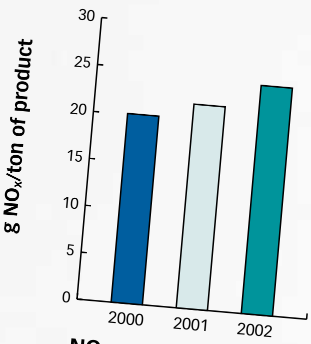
CO_2 specific emissions



emission of particles



SO_2 specific emissions



NO_x specific emissions

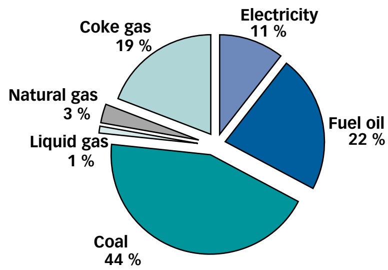
The diagrams are based partly on measurements, partly on calculations. The rising trend in carbonate products depends partly on the product mix which requires more energy than before. In addition, the fuel usage by the entrepreneurs is monitored in a more efficient way than before.

Nordkalk's emissions of carbon dioxide derive from its consumption of energy but carbon dioxide is also released into the atmosphere during the actual process of making quicklime. Carbon dioxide is released from calcium carbonate under the influence of heat and the final product is calcium oxide, quicklime. Theoretical calculations indicate that about 34 per cent of the carbon dioxide produced by Nordkalk comes from the fuel used and about 66 per cent from the calcination process. Quicklime is an irreplaceable raw material for both environmental and industrial purposes. In some of the processes employed by Nordkalk's customers, such as the manufacture of paper pigment PCC, for example, the carbon dioxide released when the lime is burnt is reintroduced into the product in the precipitation reaction.

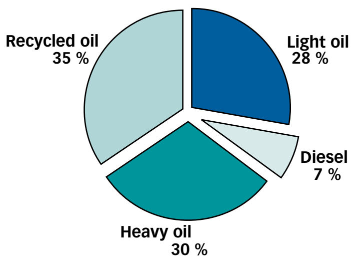
Energy-saving agreement

Nordkalk's three main plants in Finland - at Lappeenranta, Pargas and Tytyri, Lohja - have joined the Ministry of Trade and Industry's voluntary agreement on energy saving. At those locations where the energy-saving agreement is not in force efforts are nonetheless made to follow the same norms and reduce consumption of energy. An important aim in 2003 is to make the saving measures used at locations subject to the agreement better known to plants at other locations. Pargas and Lappeenranta completed their energy analyses in 2002 and the Tytyri analysis was completed at Christmas in 2001. The analyses of how energy might be saved in both production processes and construction technology were carried out by authorised energy inspection consultants. As a result of the analysis a plan for more efficient energy-saving measures was drawn up for each location. Putting this plan into practice will be the responsibility of the local management. When the energy analyses were made attention focused on operating methods that affect energy consumption. These do not necessarily require any new investment and they can be easily adopted. Improving energy efficiency also reduces carbon dioxide and other emissions and the agreement helps Finland to achieve its international clean-air obligations on emissions.

Sources of energy



Fuel oils separated



Environmental products

Nordkalk also develops and markets products for environmental care. Different kinds of limestone-based applications can be used to prevent and remedy environmental problems. Sales of environmental products increased somewhat last year and accounted for 13 per cent of Nordkalk's total turnover.

Nordkalk Velox has been evolved with the specific purpose of finding more efficient ways of composting and combating waste as well as reducing the unpleasant odours often associated with water purification plants. Nordkalk Velox is particularly well suited for use at composting plants and at open pit composts that handle bio-waste and different wastewater and industrial sludges.

Nordkalk Filtra product family comprises different kinds of limestone filters that make it possible to clean water in situations where traditional methods are unsuitable. The products are best suited to use in small units that are not served by the communal wastewater system.

The acidification of watercourses comes primarily from air pollution in the form of acid rain. Liming helps to return the quality of the water to what it was before acidification. Nordkalk's long-term work stretching over several decades has won the company worldwide renown as an expert on liming lakes and watercourses. Sweden has the largest state-funded liming programme in the world. Nordkalk participates actively in this programme in its capacity as an expert on the liming of watercourses and forests.

The production of energy leads to air pollution through acid emissions, which can lead to acid rain, for example. In order to reduce emissions from power plants, the sulphur dioxide (SO_2) of the flue gases is cleaned with the aid of carbonate products, quicklime (Nordkalk's QL products) and slaked lime (Nordkalk SL products).

The sulphur dioxide in flue gases from coal-fired power plants can be reduced by means of ground lime in scrubbers or by semi-wet technology with slaked lime. Both methods can reduce the amount of sulphur dioxide by more than 90 per cent.

When incinerating waste emissions of chlorine and fluorine (HCl, HF) exceed those of sulphur dioxide. Limestone-based products can be used to reduce these, too. In some plants the flue gases are scrubbed with water and the resulting acid water neutralised by means of ground slaked lime. Slaked lime can also be injected into the flue gas duct of the plant before particle separation. The incineration of waste is very common in Sweden and Central Europe, for example.

Environmental measures 2002

All Nordkalk's production plants have development projects in progress, and routines for monitoring and supervising are being improved all the time. The most important aims of Nordkalk's environmental measures are to reduce dust emissions and noise and to make more efficient use of limited resources, such as stone and fuels. Our environmental management system has led to many improvements. Safer handling of waste oil and more efficient sorting of general waste may be mentioned as examples. Ways of using surplus stone form part of the environmental programmes for the mines and quarries.

In 2002 Nordkalk spent a total of 2.9 million € on investment designed to reduce the adverse environmental impact of its operations. Nordkalk makes no demands on a return from this investment.

Reducing dust emissions is one of the most important environmental measures in Nordkalk's operations, and efforts to cut the amounts of dust released are being continuously improved. The effects of the measures taken are monitored, and the majority of the plants measure the dust fall-out at their location regularly. The measurements taken at Sipoo, for example, show that the amount of dust in the air round the plant has been reduced to a quarter of what it was in the early 1980's.

The lime kilns, crushing and grinding plants and loading places have been equipped in recent years with new electric and textile filters that efficiently cut the amounts of particles released. New electric filters were installed at both the Louhi plant in Finland and the Luleå plant in Sweden in 2002. As a result dust emissions have fallen markedly. At Köping in Sweden the filter for cleaning flue gases is being changed and this work should be completed by August 2003.

By scattered dust emissions is meant that extremely fine particles are spread over the environment with the wind principally from loading places, storage areas and the wheels of vehicles. By improving traffic arrangements at Nordkalk's different industrial sites the amount of dust released can be reduced and traffic safety improved. This has been done at Luleå, for example. In many locations sweeping machines have been acquired, yards covered with asphalt, wetting increased, sound barriers built and trees planted. As far as possible water from the company's own mines or quarries is used for wetting dusty areas and roads.

At Storugns on Gotland and KPAB (Kalkproduktion Storugns AB) an international R&D project financed by the EU is under way to reduce the amount of fine particles and dust.
At some locations crushing operations are concentrated to 3-4 months of the year; this reduces dust and noise at other seasons. It also means that the amount of fuel needed to dry stone can be reduced.

Nordkalk's plants make continuous improvements to **dampen the noise from machines and equipment**. Another important consideration is to up-date work routines so that exposure of both workers and the environment to noise can be reduced. Measurements of noise levels in recent years have shown that the situation is improving all the time. The project to reduce noise at the Storugns port is expected to reach completion in 2003.

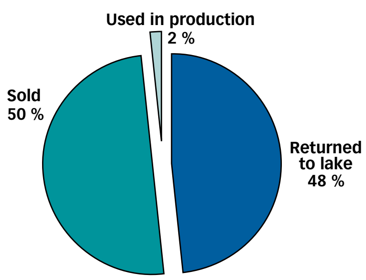
The state of both **ground and surface water** is subject to continuous monitoring. Analyses carried out at Lappeenranta, for example, indicate that the water released into watercourses from the industrial site consists mainly of rainwater and is of good quality. Nordkalk also monitors the state of ground water; there are some twenty measuring points within the Lappeenranta industrial site. The measurements show that the water is of good quality. The level of the ground water has not dropped even though quarrying continues at increasingly lower levels.

In Poland Miedzanka supplies ground water to nearby domestic households, and the Tytyri plant in Finland provides the local waterworks with ground water.

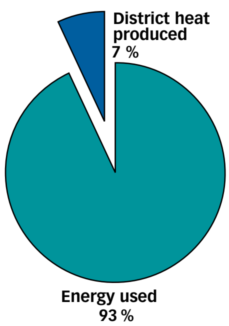
Extremely energetic efforts were taken in 2002 to **recover waste heat** from the lime kilns. Pargas invested in equipment to increase the plant's capacity to recover waste heat from flue gases and the power supplied to the town's district heating system was some 3 MW. At Tytyri a system was installed for recovering waste heat from flue gases from the shaft kiln built in 1998. This made it possible for Tytyri to supply the Lohja district heating network with waste heat from both the rotary and shaft kilns. Corresponding amounts of heat at both Pargas and Lohja towns were previously produced by means of fuel oil. This added to the greenhouse effect because of the carbon dioxide released into the atmosphere. Since this investment was made only in 2002, the increase in the amount of heat supplied to the district heating system will not be reflected in production figures until next year. Waste heat from the lime kilns at both Lappeenranta and Louhi is distributed in the form of district heating and is also exploited in the plants' own production processes.

Improvements in internal logistics have led to important savings in fuel, especially at Uddagården and Luleå, for example. Transport trips (ton kilometer) at Luleå have decreased by about 4.8 per cent. This was noted in a local project that was completed in summer 2002. Reducing the loads has also meant reduced emissions of dust.

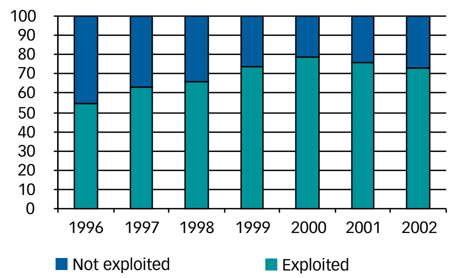
Use of mine water at Tytyri, Finland



Heat recovery from flue gases from the kilns



Exploitation of surplus stone in Finland 1996-2002



One aim of the environmental programmes at the mines is to cut the quantity of surplus stone that has to be stored and to find ways of exploiting it. In Finland the **exploitation of surplus stone** has increased 35 per cent in the last seven years.

Sales of dust recovered from the electric filters installed in the lime kilns at Pargas, Lappeenranta, Tytyri and Louhi have doubled in recent years. The plant at Köping in Sweden succeeded once again in making use of the entire amount of filter dust recovered.

The Louhi plant site at Kerimäki has put great effort into methods **of storing surplus products in mining space no longer in use.** This cuts dust considerably and the storage areas above ground do not have to be extended. Underground mining space no longer required at Louhi and Tytyri constitutes an important final dump for fly and gypsum ash from power stations according to the Finnish Environment Institute.

At many sites the areas close to the quarries where surplus stone is stored have been **landscaped** by planting trees. Landscaping at Storugns on Gotland is regarded as a part of the production process and is carried out as quarrying advances.

Lappeenranta continues its programme of landscaping the old tip for industrial waste. The work was begun in 2002 in accordance with the terms of its environmental permit. Landscaping of the tip and the planting of trees continued in 2002, and this work should reach completion in 2003.

Unexpected events affecting the environment
Last year there were two accidents at Nordkalk. A transport belt at the Pargas quarry was destroyed in a fire. This was followed by a thorough clean-up to prevent the environmental consequences. During this work Nordkalk maintained close contact with the local environmental authorities. At Miedzanka in Poland oil seeped from old, disused cisterns into the ground, after which the soil was cleaned.

Information improved
Nordkalk has evolved its own intranet to heighten the employees' awareness of environmental considerations and strengthen their commitment to environmental work. This facilitates the development of Nordkalk's environmental management system. Nordkalk's website also provides information about the company's environmental efforts.

Lappeenranta updated its local environmental report. It describes the state of the environment throughout the whole industrial site, where several other companies operate as well as Nordkalk.

Environmental Achievement of the year 2002
In a report made by a certified consultant it was noted that the environmental management system at the Pargas quarry is well organised and well run and shows that environmental questions are taken seriously. "One of the best maintained systems in the mining industry in Finland is at Pargas". On the basis of this statement it was decided to give the Pargas quarry Nordkalk's internal award of merit for Environmental Achievement of the year 2002.

Emissions

FINLAND		2000	2001	2002
emission in air:	CO_2 (t)	670 079	658 396	696 725
	particles (t)	464	453	207
	SO_2 (t)	122	90	75
	NO_x (t)	514	444	502
emission in water:	solid material (t)	80	51	5
	BOD_7,ATU (t)	8	5	1
by-product:	filter dust (t)	46 681	45 195	52 530
	* utilized (t)	29 592	29 632	37 624
	slaking residue (t)	20 425	19 191	16 028
	* utilized (t)	13 174	6 605	9 372
	surplus stone (t)	1 454 576	1 328 901	1 782 470
	* utilized (t)	1 148 527	1 005 718	1 304 445
	refining waste (t)	119 922	115 637	183 264
	* utilized (t)	25 000	65 746	39 446
	kiln waste (t)	13 531	12 299	11 526
	* utilized (t)	0	410	538
	* mine filling (t)	500	600	470
hazardous waste:	oils+greases (m^3)	58	50	58

SWEDEN		2000	2001	2002
emission in air:	CO_2 (t)	437 790	385 733	415 109
	particles (t)	99	37	116
	SO_2 (t)	128	38	50
	NO_x (t)	682	389	306
by-product:	filter dust (t)	23 637	30 980	37 607
	* utilized (t)	18 317	29 638	36 012
	slaking residue (t)	1 599	1 600	1 716
	* utilized (t)	1 599	593	1 716
	surplus stone (t)	52 343	33 759	669 407
	* utilized (t)	52 343	25 759	329 936
	washing sludge (t)	26 028	26 000	26 000
	kiln waste (t)	2 695	3 100	1 994
	* utilized (t)	500	0	0
hazardous waste:	oils+greases (m^3)	54	750	444[2]

ESTONIA		2000	2001	2002
emission in air[1]:	CO_2 (t)	25 502	25 303	34 583
	particles (t)	127	20	182
	SO_2 (t)	2	2	2
	NO_x (t)	19	19	17
by-product:	filter dust (t)	1 500	240	2 999
	* utilized (t)	1 500	240	2 999
	kiln waste (t)	480	200	557
	surplus stone (t)	30 500	31 179	61 597
	* utilized (t)	30 500	0	0
hazardous waste:	oils+greases (m^3)	5	5	4

POLAND[3]		2000	2001	2002
emission in air[1]:	CO_2	706	9 264	7 993
	particles(t)	6	19	12
	SO_2 (t)	1	6	6
	NO_x (t)	1	24	20
by-product:	process waste (t)	2 300	0	0
	surplus stone (t)		331 944	333 623
	* utilized (t)		293 625	333 632
hazardous waste:	oils+greases (m^3)	not noticed	21	19

1) The tables are a summary of measured and calculated figures.
2) As a consequence of a change in the law, Storugns must be ready to accept waste oil from the ships visiting the harbour.
3) The increased emissions arise from the considerable expansion of the operations after the acquisition of the limestone company Miedzianka and after the grinding plant at Wolica was brought into use.
4) Monitoring of surplus stone has been changed.

* In addition, there are flotation plants for calcite and wollastonite and a factory service in Lappeenranta. Nordkalk´s subsidiary Suomen Karbonaatti Oy is located in Lappeenranta.

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