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sustainability by elmo

Corporate Social Responsibility

2019

Everything we as humans do leave an ecological print in nature. Each decision, every action and all behaviours can be traced in our environment. One participant alone won’t make a difference but together we can all provide for an enhanced future, here is a part of Elmo’s contribution for a better world.

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1 Company presentation

Elmo Sweden AB is one of the largest manufacturers in the world of exclusive furniture leather and a major leather supplier to the global automotive industry. The company is operating worldwide in about 45 different markets and currently employ 160 employees on a global scale with its production and headquarters located in Svenljunga, Sweden. Elmo was founded as Elmo Calf AB in 1931 and initially produced leather for the shoe industry but later diversified into furniture and leather accessories.

During the late 1970's and early 1980's the company started to concentrate the business to the furniture segment with a distinct unique selling proposition of high-end aniline leather and started to penetrate the automotive segment to enable synergies and a diversified portfolio. That business dynamic is still present today with the addition of a third segment in transport including industries such as railway, aviation and marine. Since autumn 2010 Elmo Sweden AB is part of the Rino Mastrotto Group S.p.A.

2 Early days of searching for the green route

During the 1970's and 1980's the Swedish authorities started to tighten the guidelines for environmental impact in many industries including the tanning industry, leading to the opening of an industrial part, at the already locally existing municipal waste water treatment plant. Increased pressure from authorities, in combination with customer demand for products being produced with a sound environmental process, generated a more structured environmental focus at Elmo. The appointment of a manager concentrating solely on the environmental aspect of the process back in 1984 strengthened the awareness further. Soon the environmental attentiveness was incorporated on a cross-functional scale within the organization and later it was included in the company vision as the bold mission of *"being the most environmentally friendly tannery in the world"*.

As shown in *Appendix 1* Elmo endeavours to incorporate all by-products, process remains and scrap into the recycling process generating outputs such as high performing fertilizer for local farmers, energy and biogas for vehicles. By focusing on large and returnable packaging on high running chemicals as well as "sort at source" the unsorted waste per annum have decreased from 5 600 m^3 to 20 m^3 between 1994 and 2010 equalling a reduction of more than 99.5 per cent in the process, see *Appendix 2* for more information. Elmo has been certified according to the Environmental Management System SS-EN ISO 14001 since November 2001.

3 Reducing air emissions - from solvent-based coatings to water-based coatings

Elmo's perspective on environmental awareness can be summed up as *"waste of resources has a negative impact on both the environment and our competitiveness. Therefore Elmo shall keep good house of raw-material, production equipment and all other resources. As far as possible we shall take measures benefiting the environment as close as possible to the root cause. Technical methods where problems are completely eliminated shall have priority".*

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A distinct practice of taking measures close to the source is the replacement process of solvent-based finish coatings to water-based coatings enabling much reduced air emissions. Elmo had intensified the process back in 1986 by hiring a technician from a leading West German chemical supplier on a year's basis to work in tandem with Elmo's own technicians. Parallel with that process Elmo had submitted a request to the authorities for permitting an increase of the yearly production volume due to higher demand from the markets. The authorities conditioned the request for increased production volume with a decrease of permitted annual air emissions (VOC – Volatile Organic Compound) and after clarification from the Swedish government the set conditions of late 1987 read "Air emissions are not to exceed 325 ton per annum. During the trial period the air emissions shall be reduced as much as possible. The objective should be reduced air emissions by at least 50 per cent from the current level of 325 ton per annum".

Pending the clarification from the Swedish government a working team consisting of people from Elmo and various local authorities was put together to enable the best possible outcome regarding how to reduce the air emissions. Instead of reaching the objective at hand by suggested methods of purification or combustion Elmo argued to remedy the problem by attacking the root cause – *the solvent-based coatings*. Not only would this be a more sustainable solution but also a more cost effective solution in a long-term perspective. A project manager was appointed at Elmo as well as a technician fully dedicated to transfer the solvent-based coatings to a water-based system. Since no proven water-based system was up and running within the tanning industry the task at hand needed both innovation and close support from the concerned chemical suppliers. By starting the process with the more forgiving product groups in an emission aspect, as aniline leather, progress was made but the complexity of transferring technical leather for the automotive industry without creating negative product features or quality problems prolonged the lead-time significantly. By late 1989 Elmo had ran over 300 trials with water-based coatings generating costs exceeding SEK 2 million. The upside was that all work started to pay off as the annual air emissions had dropped from 325 tons to roughly 230 tons and by 1990 the objective of reducing air emissions by 50 per cent was achieved with a comfortable margin – see *Appendix 3* for more information.

Triggered by the success and the desire to drive water-based systems within the tanning industry the work continued and by 1994 all Elmo products had completed the 6 phases/gates required for transfer approval generating a decrease of air emissions by almost 90 per cent. In 2010 Elmo generated 11,3 tons of air emissions equalling a reduction of 96.5 per cent compared with 1987 (*see Appendix 3*) and a level of less than 10 percentage compared to the "VOC EU Directive" of 85 gr/m^2 as shown in *Appendix 4*. According to the IPPC (Integrated Pollution Prevention and Control) Directive of "Best Available Techniques in the Tanning of Hides and Skins" by the European Commission, the average industry output of VOC or organic solvents is approximately 40 kg per processed ton raw-hides, Elmo's level of output for the same amount of processed raw-hides is only 1 kg of VOC or approximately 97 per cent less than industry average. Not only did Elmo excel in reference to the air emission objectives by addressing the root cause instead of looking for the fix by purification or combustion, but also provided industry benchmarks for water-based coatings together with the involved chemical suppliers, and set the tone in the quest for best in practice.

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4 Reducing the environmental impact of discharged water – innovated nitrification and de-nitrification solution

Since the tanning process is a very water intensive procedure the focus has naturally been to reduce the environmental impact from the discharged water. Initially the work was done by addressing different root causes in the tanning process and working in tandem with the local municipal waste water treatment plant in order to optimize the purification process. But by early twenty-first century the decrease trend of key parameters had somewhat stagnated.

In order to make further progress and achieve additional improvements, the company needed to introduce a new waste water treatment process for the tanning industry in order to reduce the environmental impact. The present situation with dependence of the local municipal waste water treatment plant was a barrier for Elmo to enable increased production volume giving the authorized permits, as environmental authorities in Sweden were obliging the company to reduce the nitrogen pollution. The reduction of nitrogen discharge to rivers and lakes had for several years been a priority in Sweden as high nitrate levels can cause eutrophication of watercourses and polluting groundwater's in the process. Elmo needed an innovated solution in the quest to reduce the environmental impact further. Therefore Elmo initiated the plan to build a new waste water treatment plant in 2002 with the distinct objective of achieving a stable nitrogen removal of more than 80 per cent (current technologies achieve a reduction of about 30 per cent, so the project's results have significant transfer potential for other European tanneries according to the project report on the European Commission – Environment - LIFE programme website). The nitrogen removal should not be affected by changes in the composition of the waste water nor by the harsh winter conditions in Svenljunga, where temperatures of -20°C is a reality from time to time.

4.1 Tanwater project

The preparative phase consisted of three parts:

- Selection of technology.
- Applications to authorities for a building permit and an environmental permit.
- Application for financial support from the EU LIFE financial instrument in order to obtain financial support.

The project started by an extensive survey of results from other waste water treatment plants. The study showed that nitrification and de-nitrification of tannery waste water in order to reduce the nitrogen content in the waste water had briefly been discussed as an option in countries with strict nitrogen discharge limits. However, due to severe difficulties in controlling the process and odour issues the process had not been introduced or considered feasible to introduce for treatment of tannery waste water. Only a few attempts with a nitrification and de-nitrification process within the tanning industry had been initiated but the experiences showed that the process gets disturbed regularly and it has therefore not been considered as a technique applicable to tanneries. The EU BREF-Document (IPPC-Directive) for tanneries state

"Due to the difficulties in controlling this process (nitrification and de-nitrification), it cannot be considered general practice for individual plants".

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The removal of nitrogen from effluents by nitrification and de-nitrification is used by some municipal wastewater treatment plants in Europe as the waste water entering such facilities are easier to treat than waste water from tanneries. In the first biological process (nitrification) the ammonia nitrogen is oxidised into nitrate. This process takes place under aerobic conditions, i.e. in the presence of oxygen. In the second process (de-nitrification), the nitrate is reduced to gaseous nitrogen, which escapes into the atmosphere. The de-nitrification takes place under anoxic conditions. The innovation in the project was to utilize the nitrification and de-nitrification technology used at various municipal waste water treatment facilities and incorporate it to apply for waste water generated by tanning despite concerns from earlier attempts within the industry.

One of the major suppliers of nitrification and de-nitrification systems in Europe performed laboratory trials together with Elmo for a period of up to 8 months. The initial trials were successful and the results were used for up-scaling the trials in order to effectively demonstrate that the technology can be used on waste water from tanneries. During the trial process some important success factors were established in order to obtain a stable purification process. The waste water plant need a strict process control (especially pH and balance of nutrients is important), the facility need a 2-step process (toxic compounds degraded in step 1) and have the possibility for hydraulic equalization (to avoid fluctuations in e.g. chloride concentration).

The first contacts regarding the waste water treatment plant was taken with the relevant environmental authorities in February 2002 and the application for a permit was delivered by March 2003. The building permit was received by the local authorities by late 2003 while the environmental permit was achieved in February 2004, which was later than expected. As a result of the time-consuming process to receive the environmental permit the actual start of the construction of the plant was delayed by more than 6 months.

An application for financial support from LIFE was prepared and submitted under the project name Tanwater in November 2002 to the European Commission and was eventually granted a funding of EUR 913.999. LIFE refers to its operations as “The LIFE programme is the EU’s funding instrument for the environment. The general objective of LIFE is to contribute to the implementation, updating and development of EU environmental policy and legislation by co-financing pilot or demonstration projects with European added value”. This approach enables demonstration and development of new methods for the protection and the enhancement of the environment.

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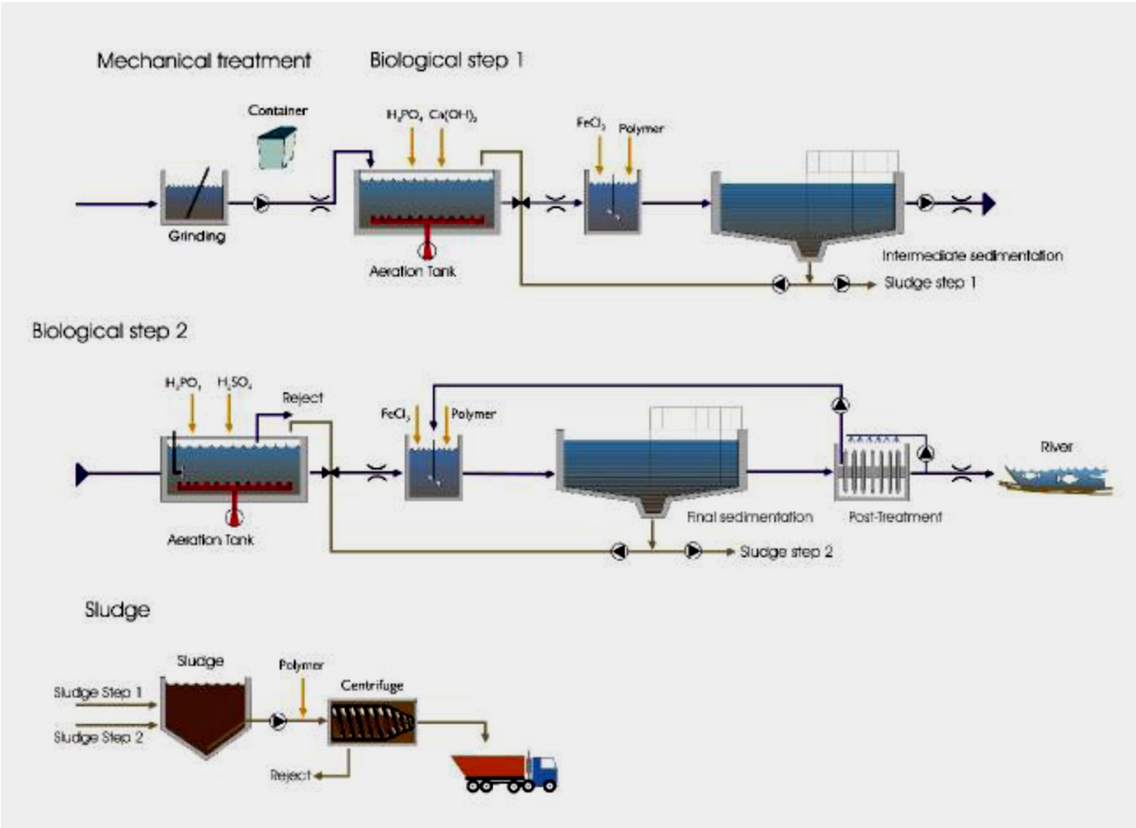
4.2 Technical description of Elmo's nitrification and de-nitrification plant
An overview of the plant flow is given below and followed by a description of the plant process.



The wastewater flows from the tannery to the new inlet pumping station through a 2mm screen.
The wastewater is then pumped to biological treatment as follows:

Step 1 – Biological treatment *(Equalization and removal of COD and toxic matter)*
The waste water is pumped into the first aeration tank, which has a volume of 2000m³. The tank serves as a buffer tank for equalization of flow and pollutants. At the same time the tank is used as an aeration tank where micro-organisms are grown to oxidize a great part of the organic matter and sulphide in the waste water. From the aeration tank the wastewater flows to a deaeration tank where iron salts and polymer can be added to improve performance of the first settling tank. In the first settling tank most of the suspended solids in pretreated waste water are removed. Excess sludge is pumped to sludge dewatering in the existing sludge dewatering building. Sludge can also be pumped back into the aeration tank to improve removal of organic matter in the system. Pre-treated wastewater is collected at an intermediate pumping station. The wastewater is pumped into the second aeration tank at intervals depending on the operation mode in the aeration tank.

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Step 2 – Biological treatment *(final purification)*
The final purification of the waste water takes place in the second aeration tank. The tank is designed with a big volume (5100m³) so biological nitrogen removal can take place. Nitrogen is mainly present in the waste water as ammonia. The nitrogen removal is a biological process performed by two processes: nitrification and de-nitrification. In the first biological process the ammonia nitrogen is oxidized into nitrate. This process takes place under aerobic conditions, i.e. in the presence of oxygen. In the second process (de-nitrification), the nitrate is reduced to gaseous nitrogen, which escapes into the surrounding atmosphere. The de-nitrification takes place under anoxic conditions, which means that oxygen is not present or in anoxic zones of the flocks. From the aeration tank, the waste water flows to a deaeration tank where iron salts and polymer can be added to improve performance of the final settling tank.

A flow-controlled sampler is used to check the pollution levels of the treated water. After this process, the treated water is discharged. The major part of the sludge will be pumped back to the second aeration tank, while a minor part of the sludge is pumped to sludge dewatering in the existing sludge dewatering building. It is important for the stability of the nitrification/ de-nitrification that micro-organisms from the sludge are transferred back to the aeration tank. In order to reduce fluctuations in the process a high degree of control and monitoring systems have been included in the plant.

4.3 Summary of Elmo's nitrification and de-nitrification plant
The construction of Elmo's waste water plant started in March 2004 and the first trials of the plant started in January 2005. These trials consisted of dry test of the machinery (pumps and other equipment). The wet trials of the plant (testing pumps, pipes and other equipment) using water started in February 2005. During March 2005 the construction of an active biomass started using activated sludge from the municipal waste water treatment plant as starting material. Initial trials using actual waste water started in April and later the same month the first water was discharged from the treatment plant to the nearby river. The monitoring programme was finally defined and approved by the regional environmental authorities in June 2005. A high number of parameters are controlled and submitted to the authorities on regular basis in accordance with the permits.

The investment cost of the plant was EUR 4.3 million (total cost for project slightly above EUR 5 million) and the plant has been dimensioned for a flow of around 1250 m³/day.

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4.4 Environmental Performance of Elmo's nitrification and de-nitrification plant

The main objective with the substantial investment was to reduce the Nitrogen in the discharged water by more than 80 per cent as well as improving other key parameters. As shown in *Appendix 5* the positive trend enabled by the transfer to a nitrification and de-nitrification plant is significant in reference to Nitrogen. *Appendix 6* gives a distinct perspective of the performance on the specific parameter. Compared to limit the Elmo nitrification and de-nitrification plant performance is considerably lower than permitted. Initially there were concerns in reference to the guideline limit values for other key parameters as BOD (Biochemical Oxygen Demand), Phosphorus and Chromium as shown in *Appendix 7-9*. After a rigorous analyse the purification process was slightly modified in late 2007 by the implementation of a post-precipitation with Ferric Chloride leading to a significant improvement of all three parameters as seen in the diagrams. The treatment effect can be seen in Appendix 10, Nitrogen reduction reaching nearly 97 per cent. The BOD and Chromium reduction are well over 99 per cent and have set a benchmark for best in practice within the tanning industry.

The Tanwater project and Elmo received honourable citation for the innovated waste water treatment plant during the ceremony concluding the best LIFE-Environment projects for 2006-2007 (*see Appendix 11*). According to the web summaries on the LIFE programme website "the new waste water treatment technology also gives better results than the current best available techniques (BATs) for the tannery sector". Below is a picture from above of Elmo's innovated waste water treatment plant.

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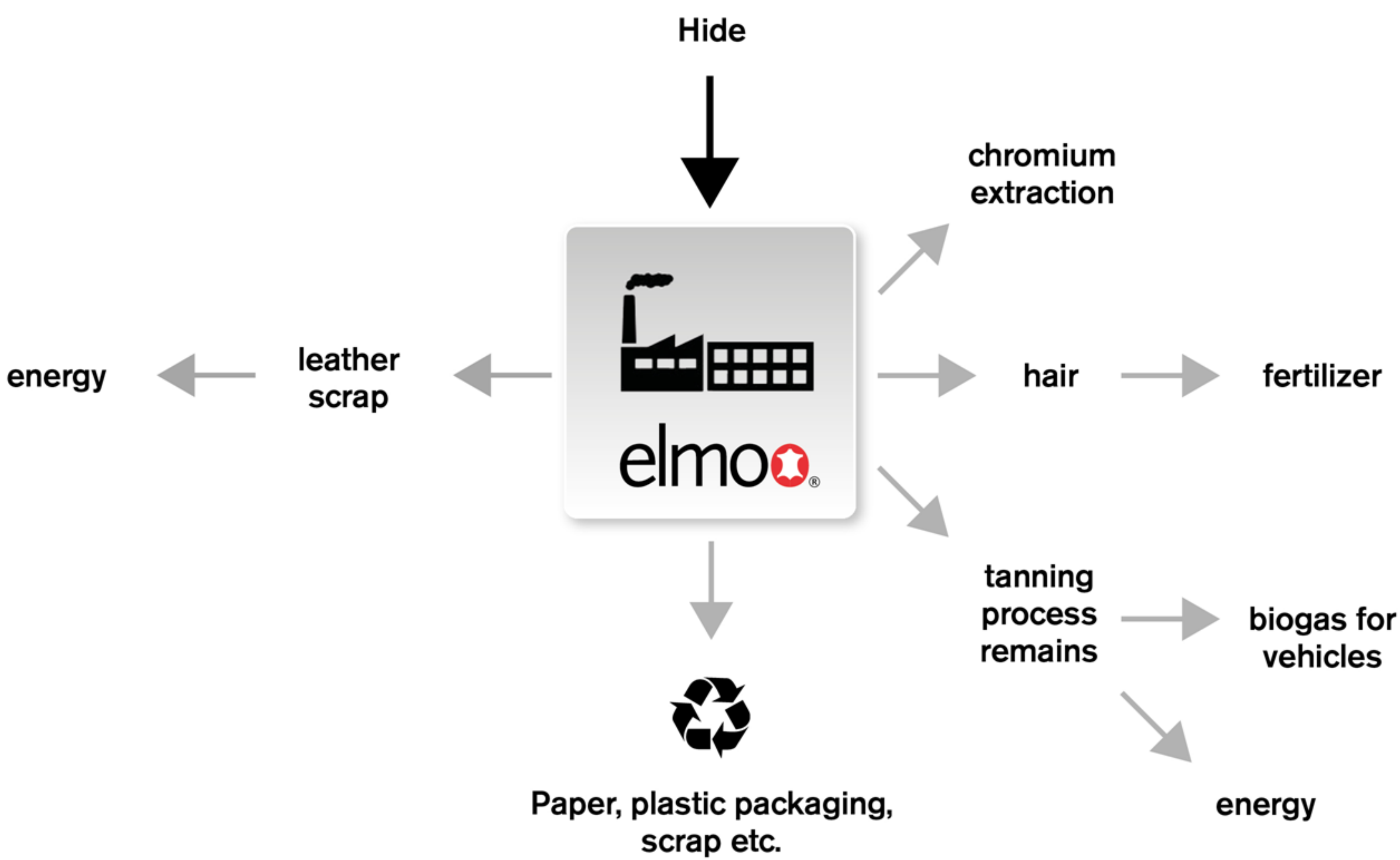
5 Elmo's environmental mission - benefits for customers, local community and interested parties
As part of the contract with the European Commission, Elmo has performed a number of dissemination activities regarding the Tanwater project to stakeholders (tanning industry, other industries with similar waste water, e.g. textile industry, consultants, waste water treatment companies, authorities, decision makers and the general public) to enable distribution of know-how in reference to the high performing nitrification and de-nitrification solution. A similar scenario was generated by the air emission program of introducing water-based coating back in 1980's and 1990's, the suppliers that Elmo worked in tandem with obviously supplied the know-how and their newly developed products to the industry in general. By willingness to introduce innovating solutions and focusing on the root cause Elmo has in many ways driven the industry in terms of environmental awareness by its transparency.

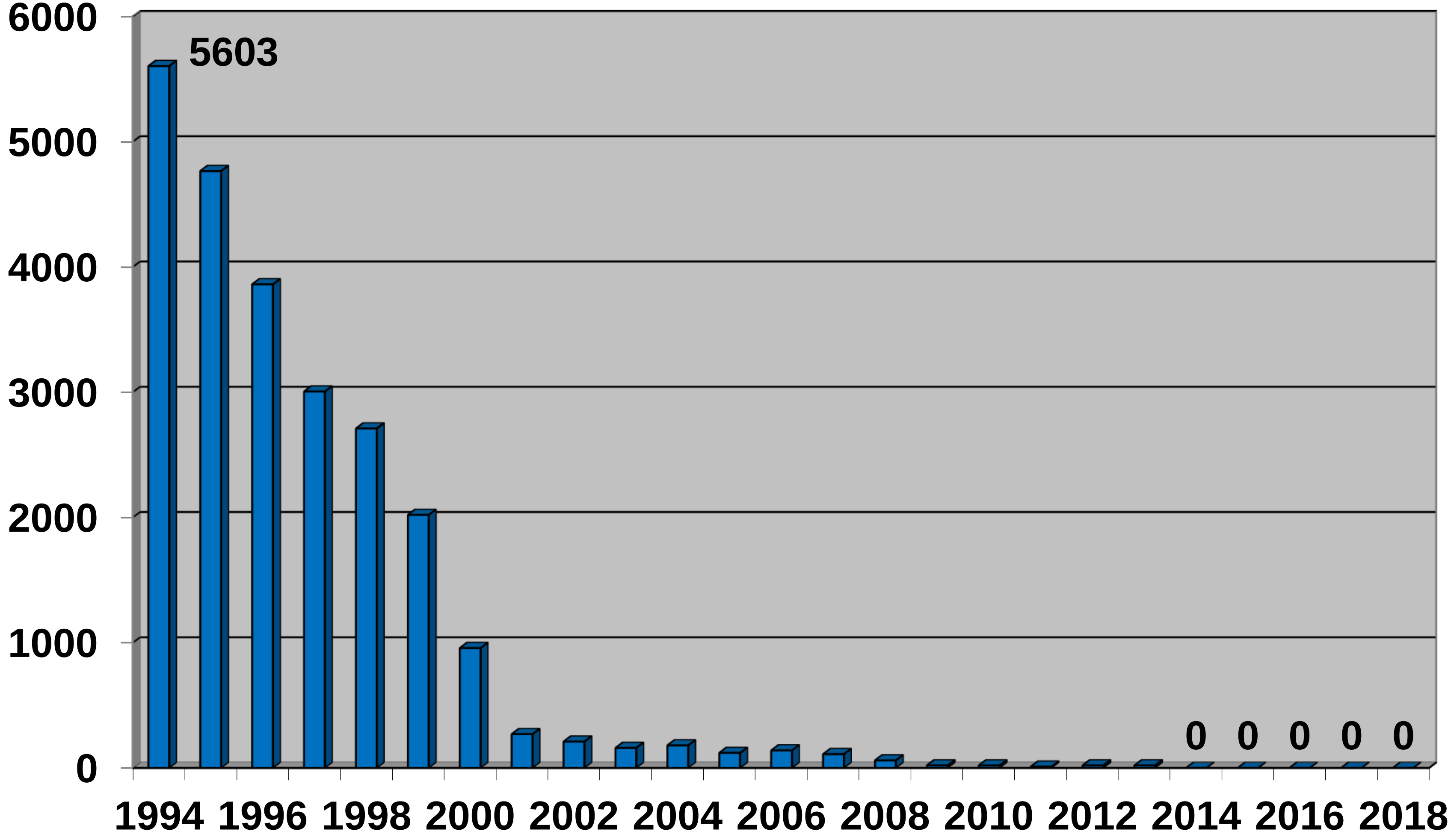
Elmo's environmental mission, of having a responsible and sustainable approach in reference to the ecological impact of its business, obviously generate benefits for the local community as well - during the last 3-4 decades weighty improvements have been made in terms of the company's effect on water and air conditions. For customers, many with demand of sustainability, it's a receipt of accountability and can be used in the marketing process towards end customers to enhance brand values and possibly increase sales. The quest will carry on, one participant alone won't make a difference but together we can all provide for an enhanced future, and the rewards are there to be reaped.

Recycling process

Appendix 1



Un-sorted/dumped waste m^3/year



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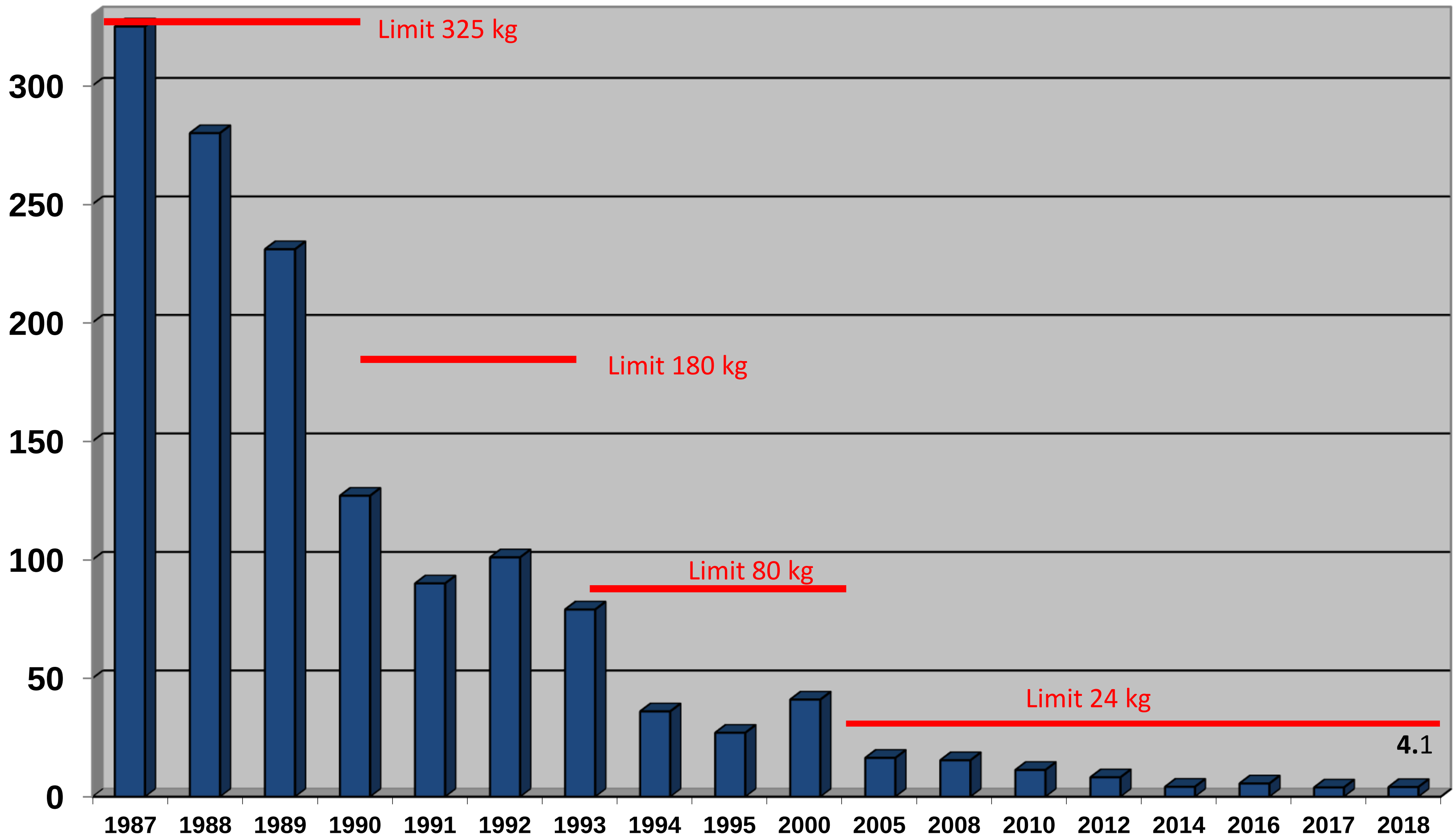
Air emission VOC — ton/year

Appendix 3

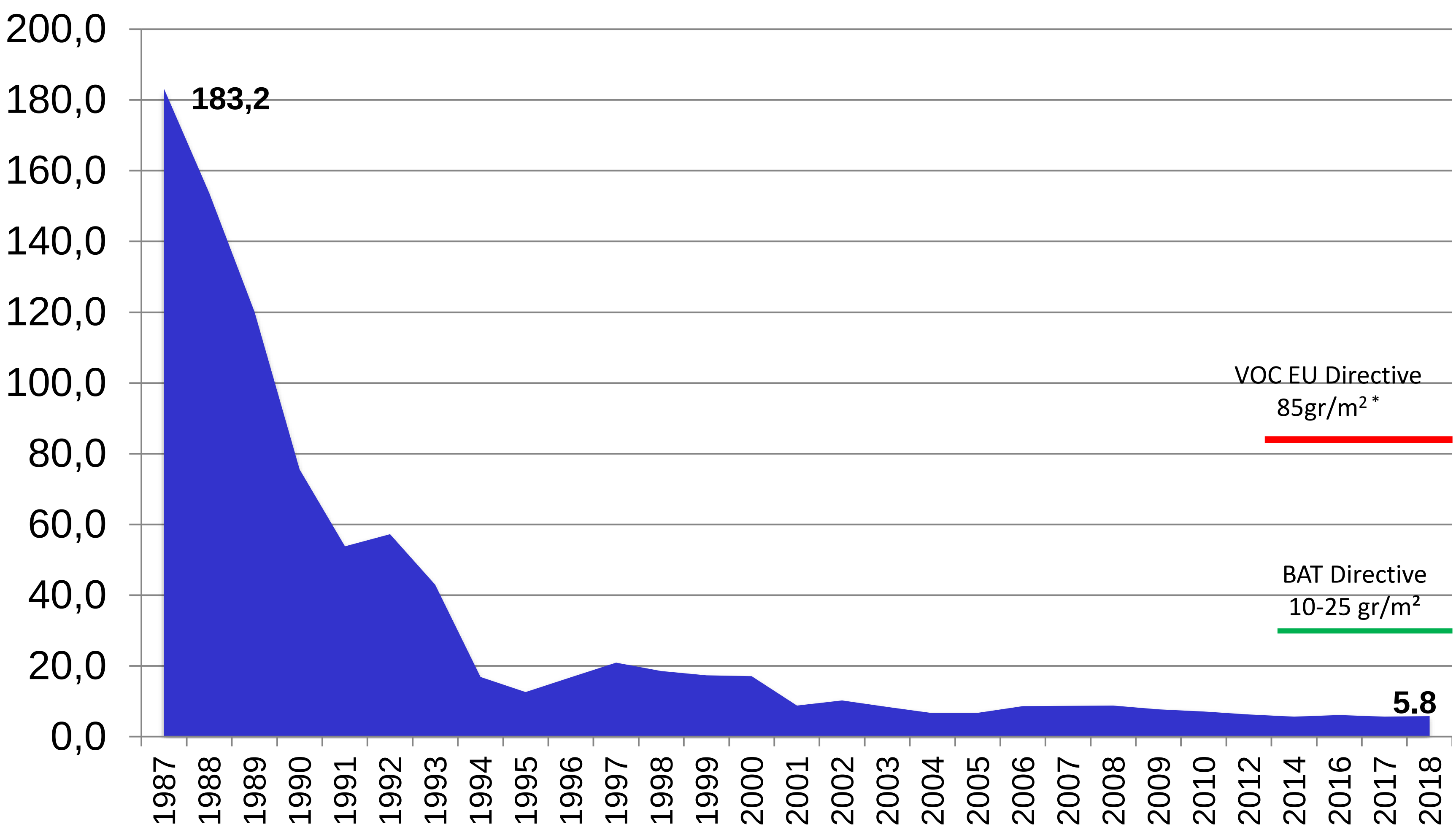
VOC – Volatile Organic Compound



Air emission VOC — gr/m²

Appendix 4

VOC – Volatile organic compounds



*)Council Directive 2013:254 on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain activities and installations

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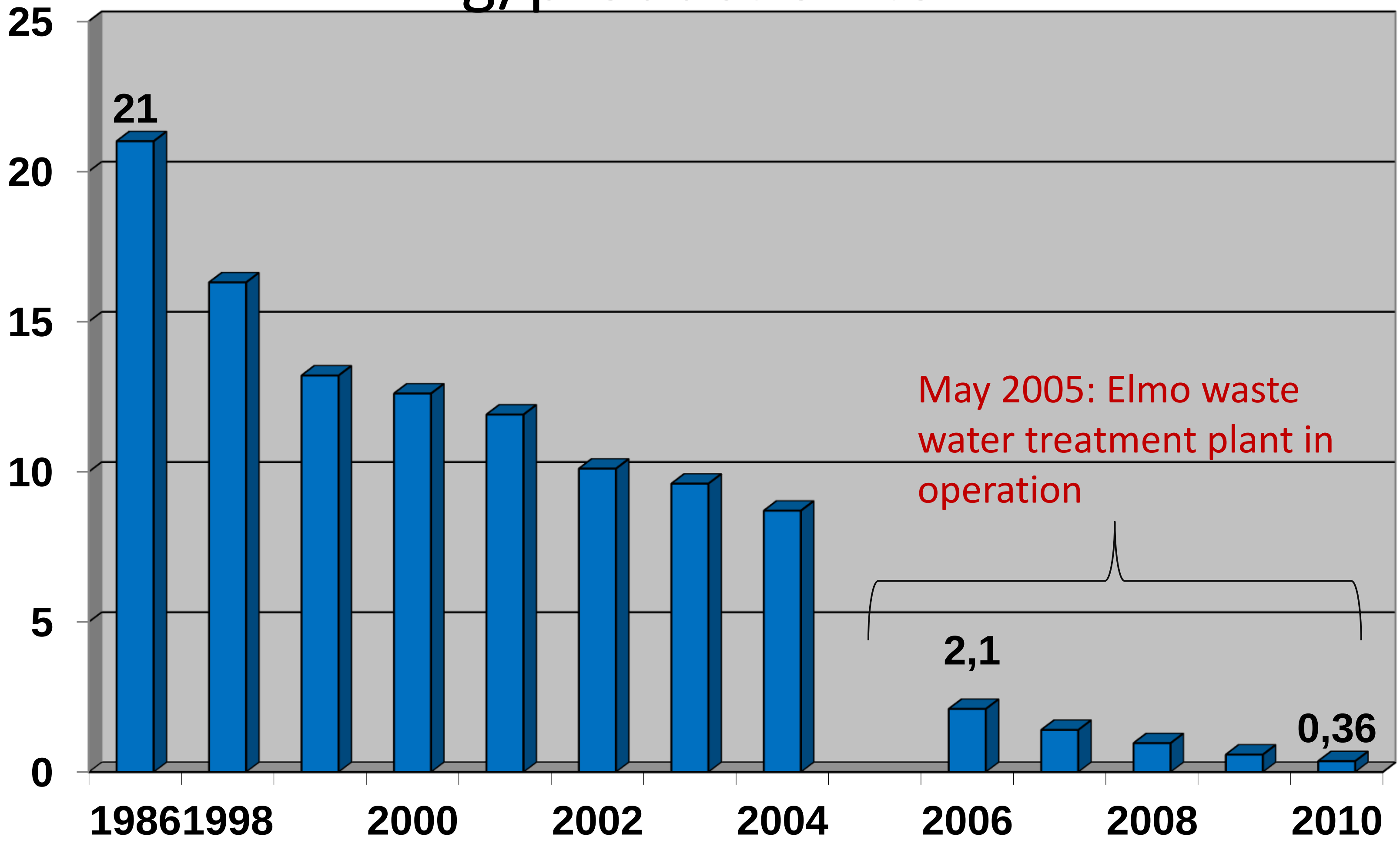
Discharged water — nitrogen kg/production ton

Appendix 5



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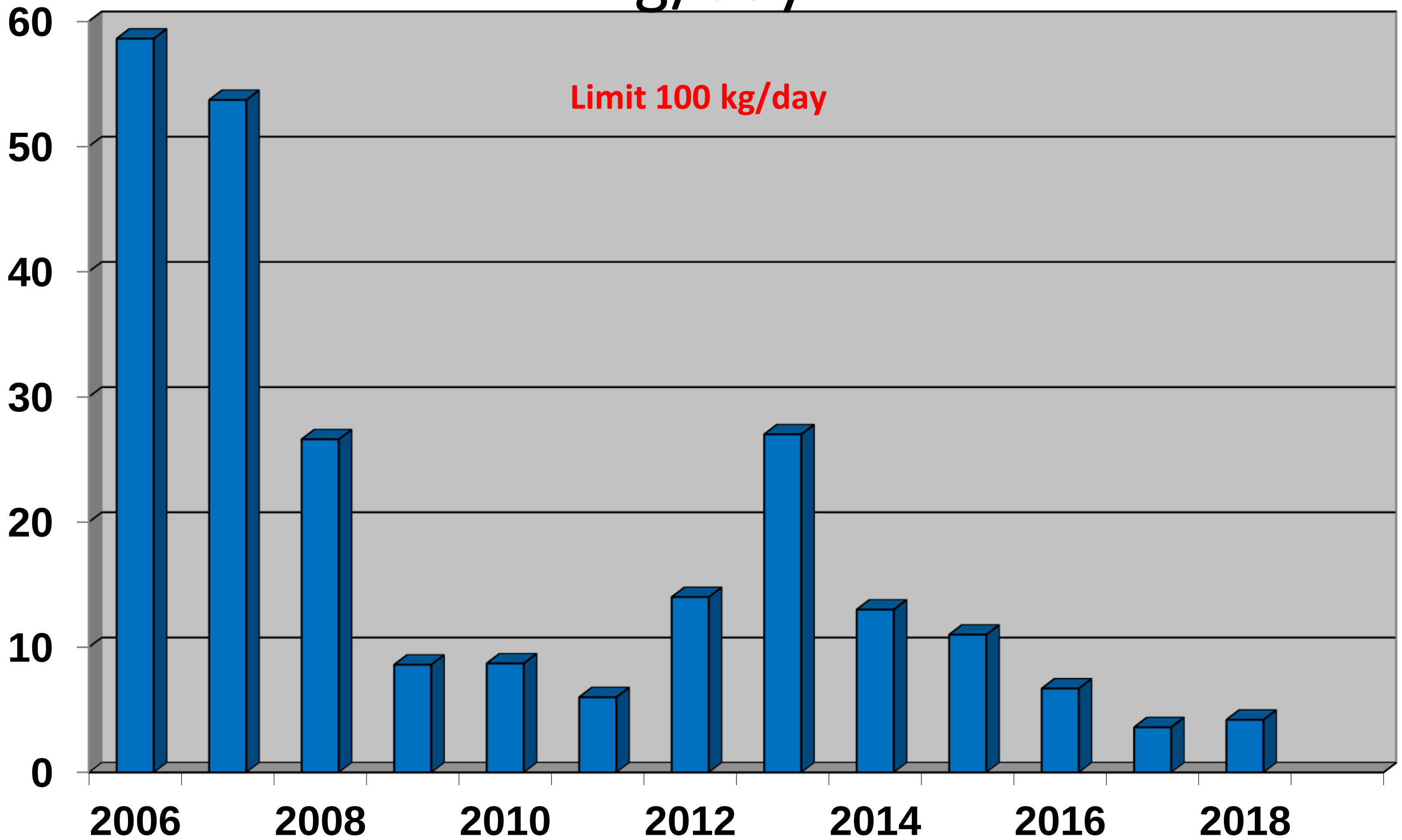
Discharged water — total nitrogen kg/day

Appendix 6



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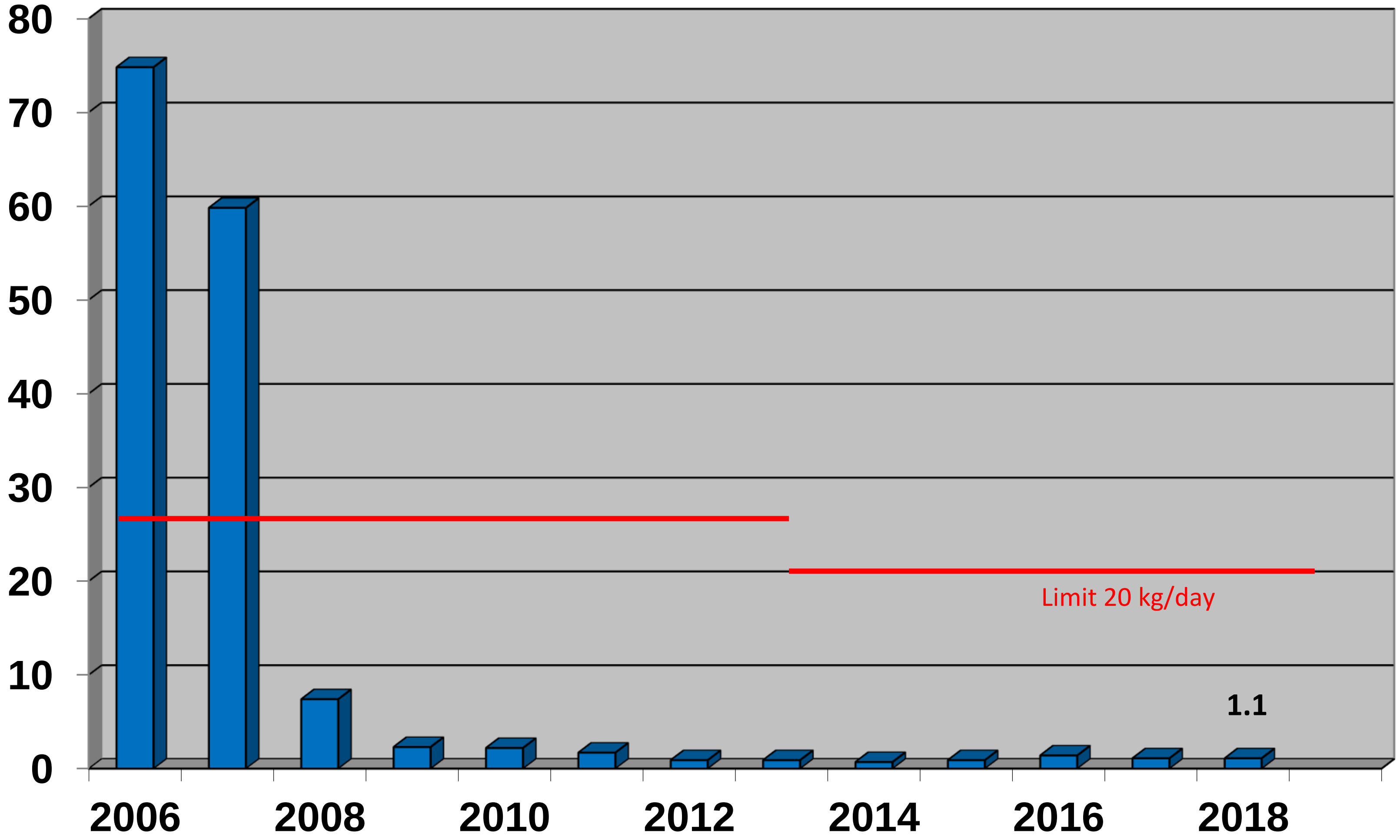
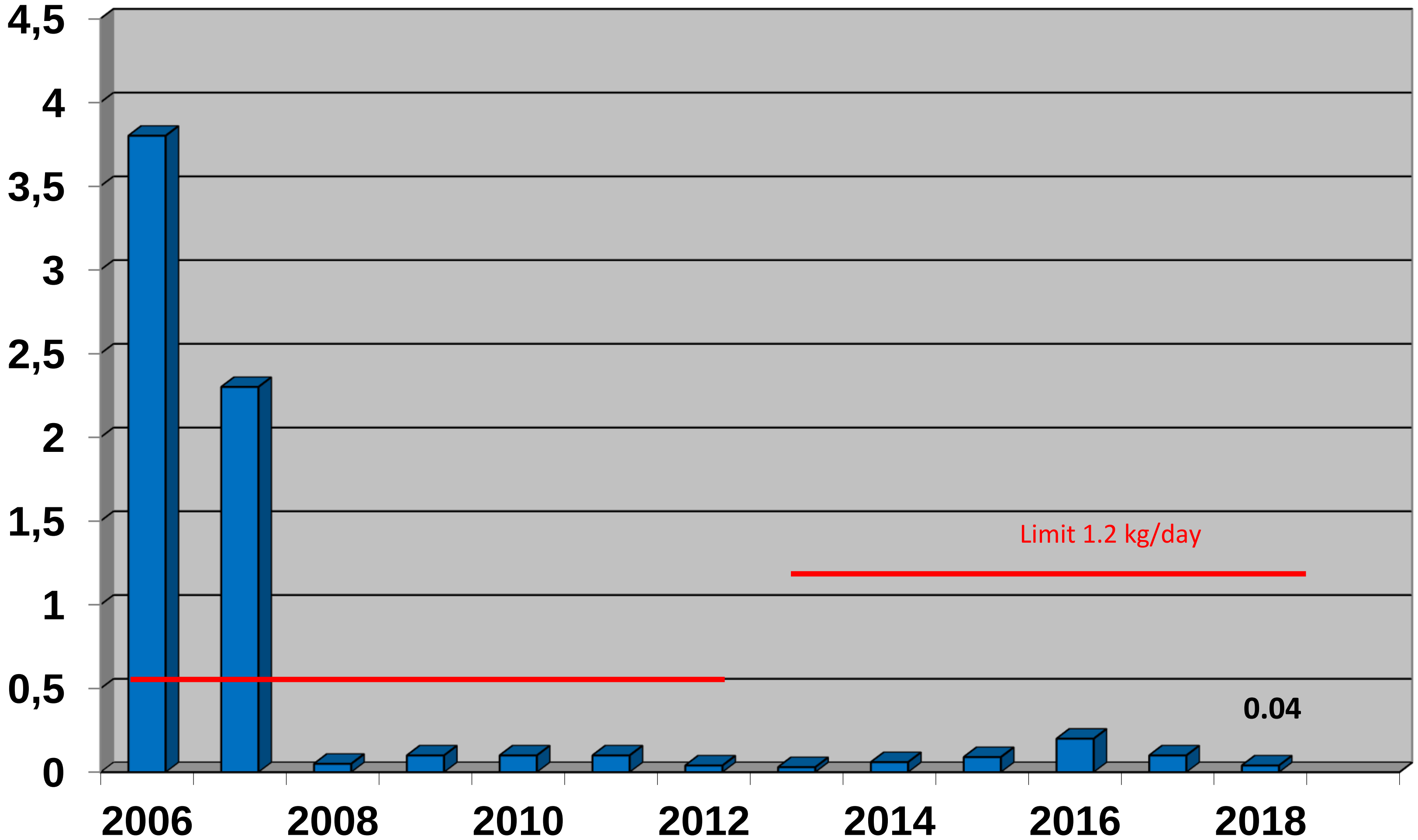
Discharged water — total BOD kg/day

BOD — Biochemical Oxygen Demand

Appendix 7



Discharged water — total phosphorus kg/day



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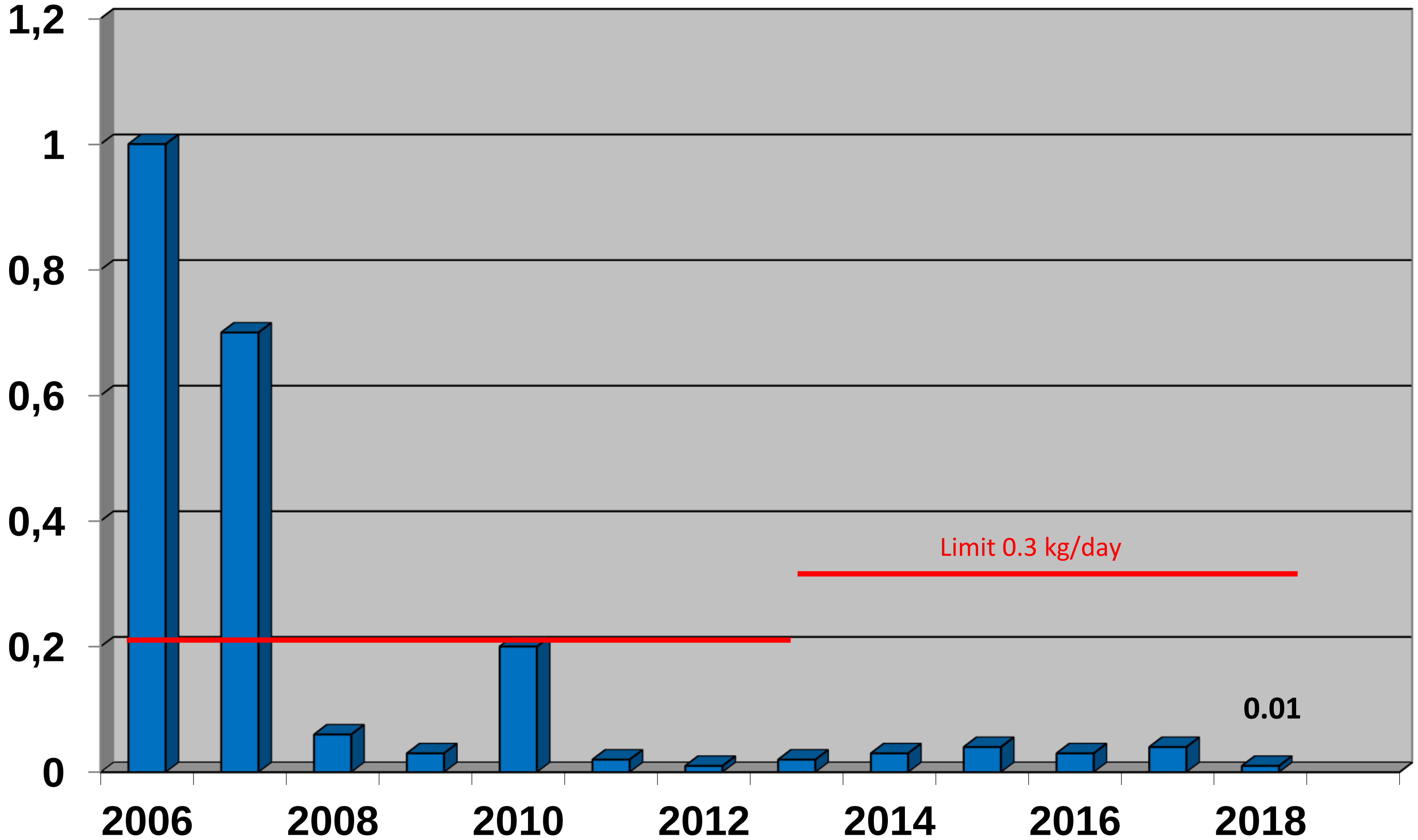
Discharged water — chromium kg/day

Appendix 9



Elmo waste water treatment plant

Appendix 10

(nitrification and denitrification waste water treatment)

treatment effect on key parameters

	input (mg/l)	output (mg/l)	Reduction %
BOD	4 000	<3.0	99.9
COD	7 500	65	99.1
Nitrogen	280	9.3	96.7
Chromium	4.0	0.02	99.5
Phosphorus	16	0.08	99.5

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