Nordic Ecolabelled

Textile services

Draft consultative document

Background document for ecolabelling

21 June 2012

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Nordic Ecolabelled Textile Services – Background document for ecolabelling

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1 Summary

Textile service providers rent out, launder and dry clean textiles for both private and public sector customers. To qualify as a Nordic Ecolabelled textile service provider, a number of strict environmental requirements must be met. These concentrate on the main environmental effects of the service in a life cycle perspective. Accordingly the criteria focus on the laundry's consumption of energy, chemicals and water as well as purchases of textiles, distribution and processing of waste etc. At the same time a Nordic Ecolabelled laundry must comply with the quality and working environment requirements imposed by the industry association in the country in which it operates. The following chapters discuss the background to all the requirements imposed in the criteria document.

2 About the criteria

Products that are eligible for an ecolabel
The product group encompasses the entire range of textile services and a Swan label may be awarded to individual production units (laundries and/or dry cleaners) or multiple units in a chain. In the latter case, however, each individual unit in the chain must fulfil the requirements provided for in the criteria document.

Justification for Swan-labelling
As discussed in chapter 4, Swan criteria for textile services are relevant in environmental terms. Moreover, the data reveal that there are extensive differences between the environmental performances of various laundries – which means that considerable potential exists for environmental improvement. There is also considerable scope for controllability, since laundries are able to exercise direct control over the most significant parts of the life-cycle.

The version and validity of the criteria
Version 1.0 of the criteria for hand towel roll services was adopted in March 1996 and revised criteria, Version 2.0, were adopted in December 2004. Since December 2009 the criteria for hand towel roll services have been combined with the criteria for laundries.

Version 1.0, the first criteria for laundries, was adopted by the Board of Nordic Ecolabelling in December 2001. In December 2009 Nordic Ecolabelling adopted new criteria which combined the criteria for hand towel roll services and laundries in a single criteria document for textile services.

The adopted criteria were assigned the product group number for laundries, i.e. Version 2.0 in force until 31 December 2012. The criteria have since been adjusted once, in December 2010, and were extended in November 2011. Thus the current version is Version 2.0, which will remain in force until 31 March 2014.

It is proposed that Version 3.0 should remain in force until 30 June 2017.

The Nordic market

A key feature of the industrial laundry industry in Europe and the Nordic countries over the last 35-40 years has been consolidation: laundry chains and – less typically – individual laundries have been bought up by major operators in the industry. This tendency is inter alia described in Arndt, 2002. Thus in 2005 in Europe 13 groups owned more than 10 production sites and the largest owned 70-80 sites each (Søgaard-Pedersen, 2006). Thus there has been a shift in the industry in the direction of fewer, larger and more specialised production units operating together in large groups (Søgaard-Pedersen, 2004).

The tendency in the Nordic countries has been the same, and major players such as UK company Davis Service Group and its Danish subsidiary Sophus Berendsen operate on both sides of the national borders in Denmark, Sweden, Norway and Finland, while Lindström of Finland (including Comforta) has operations in Finland and Sweden. These two major Nordic textile service businesses also operate outside the Nordic region. Other international players such as CWS boco og Rentokil Initial have also established business operations on the Nordic market for textile services.

In the Nordic countries (excluding Iceland) there are some 265 industrial laundry units split more or less equally between the four countries, with Sweden having a slight predominance (Søgaard-Pedersen, 2004).
In Denmark, the two largest operators on the market (Berendsen Tekstil Service and De Forenede Dampvaskerier) account for 70-80% of the total turnover of the industry (Danish Competition and Consumer Authority, 2009). Some 95-100 small and medium-sized enterprises account for the remaining 20-30% of turnover (Danish Competition and Consumer Authority, 2009). Although some uncertainty attaches to this figure, the Danish Competition and Consumer Authority (2009) has estimated the total turnover of the industry to be in the region of DKK 3-3.5 billion, which is somewhat more than the industry's own figure of approximately DKK 2.8 billion (DI Service, 2011). The difference between the two figures may be attributable to the fact that the industry association's figures only take in larger commercial laundries.

Sweden has a total of approximately 525 laundries if one includes the 400 or so small dry cleaners/laundries (a dry cleaner is normally a business that uses organic solvents for cleaning the textile, whereas the laundry uses water with the addition of some chemicals) that primarily serve the ordinary consumer. The total turnover of the industry is some SEK 3 billion, the major share – approximately SEK 2.5 billion – being taken by the industrial laundries. Industrial laundries in Sweden employ some 3,500 people. Thus the average Swedish industrial laundry is slightly smaller in terms of both number of employees and turnover than the typical laundry unit in the West as described above. Over the last five years the industry has invested in modern technology, moving in the direction of a more automated process.

In Norway there are approximately 50 dedicated laundries, 50 combined laundries/dry cleaners and 200 dedicated dry cleaners (Christensen, 2008). Total sales by the industry in 2007 amounted to approximately NOK 2 billion (Statistics Norway, 2008). There are two major chains in Norway: Breezegruppen, formerly known as TekstilPartnerNor AS and NorTekstil with 12 and 18 industrial laundries, respectively

(Breezegruppen, 2012; NorTekstil, 2012). Both chains cover the entire Norwegian market and offer textile laundry services within all categories. Berendsen Tekstil Service AS also has operations on the Norwegian market with six units offering laundry services for work clothes, mats, mops, and hand towels rolls (Berendsen, 2008). As discussed above, in addition to the chains there are a number of independent laundries and dry cleaners as well as some hospital laundries (NRV, 2008).

The largest operator on the Finnish market is Lindström Oy (Helle, 2008; Lindström, 2008). Berendsen Textile Service also has a presence in Finland. In addition to the chains there are a large number of independent hospital laundries and other laundries – some of which cooperate in their marketing. Including dry cleaners and small laundries there are some 400 textile service providers in Finland with a total turnover of approximately € 250 million (Räsänen, 2008).

Where laundering is insufficient to clean a textile, many industrial laundries have now moved away from dry cleaning the textile themselves, preferring to use subcontractors. More textiles are now able to withstand washing with water than was the case previously, although there is still a small group of particularly delicate textiles that cannot withstand washing.

Swan licences

During the early years, the criteria for laundries had only limited success, but in recent years there has been an upturn in the number of laundries seeking a Swan licence. This is also illustrated in the table below showing the number of laundries with licences to display the Swan label in the various Nordic countries.

Table 1. Number of Swan-labelled laundries in the Nordic countries.

Country	Swan-labelled laundries	Registered laundries
Denmark	23	1
Finland	1	0
Norway	23	0
Sweden	16	0
Total	**63**	**1**

Other labelling schemes

Many laundries are certified to ISO 14001 or EMAS as well as meeting their industry association’s requirements as to quality, environment and working environment. The

Nordic Ecolabelscheme imposes specific requirement levels on environmental impact, something that the environmental management systems do not do. Businesses that work with management systems will often find it easier to compile and document the necessary information for the Nordic Ecolabelscheme.

3 About the revision

The aim of the criteria revision
The purpose of this project is to present revised criteria for textile services, the primary aim being to adapt the requirements in the following areas:

- Energy & climate
- Water consumption
- Distribution
- Laundry chemicals
- The purchasing of rental textiles

About this criteria development process/revision
The criteria were revised by a Nordic Project Group between January 2012 and December 2012. The revision process has been based on an evaluation of existing criteria and the collection of information and data from the industry.

During the revision process the project participants engaged in a fruitful dialogue with the industry and, inter alia, compiled key environmental figures from over 70 laundries in the Nordic countries. This provides a sound basis for setting strict but realistic environmental requirements for Swan-labelled textile services. Even so, during the consultative process we wish to receive key figures from even more laundries. We would therefore urge all operators in the industry that have not as yet submitted their data to complete and submit the spreadsheet circulated together with the consultative document. All data received will be treated in the strictest confidence.

This draft background document and a criteria document have been circulated for consultative comments.

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The Nordic Area Coordinator for the project has been Anders Moberg (Sweden).

4 Justification for the requirements

4.1 Textile services seen from a life cycle perspective

In terms of the life cycle of a textile, washing /drying processes at a laundry are of major significance, as will also be apparent from the life cycle assessments referenced later in this chapter. This is because during the course of its life cycle a textile item will be produced and disposed of "only" once, whereas it will be laundered and dried numerous times, as a result of which these processes play an important role.

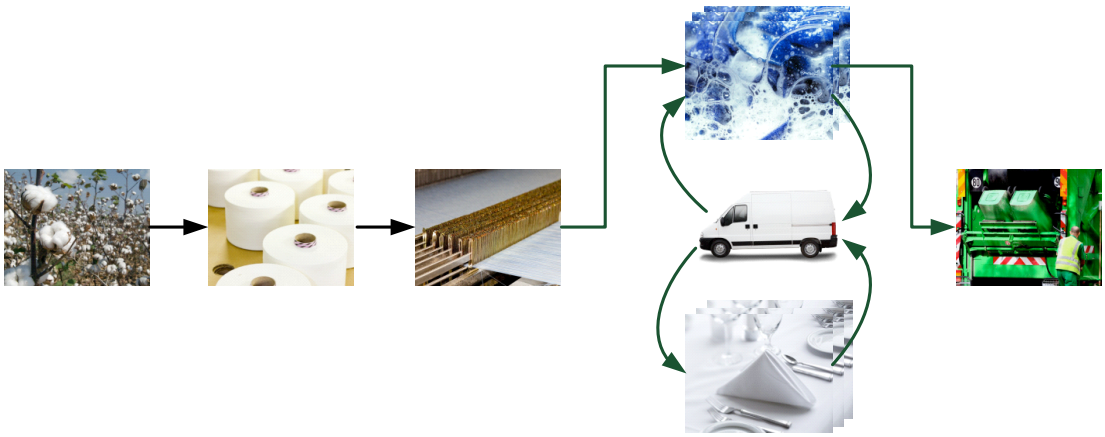

Figure 1. Example of an outline of the life cycle of a textile service.

Having looked at the product group from a life cycle perspective we have concluded that it is relevant to impose requirements which impact on all parts of the life-cycle

The laundry's consumption of energy and impact on climate

1) The chemical consumption of the laundry
2) The water consumption of the laundry
3) Textile purchases, with the relevant requirements further back in the chain
4) Distribution
5) Waste processing – including the disposal of textiles

4.2 General requirements (O1, O2, O3)

Version 2 required all subcontractors of laundry services to hold Swan licences. This proved to be impractical, since the quantities of laundry sent out to subcontractors will often be very small and will accordingly be of limited environmental relevance. For this reason we have imposed a triviality threshold in Version 3 of the criteria, according to which subcontractors of laundry services performing less than 1% need not hold Swan licences. Nevertheless, the subcontractor must fulfil a number of requirements relating to the constituent substances in the chemicals used in the service provided to the Swan-labelled customer.

In order for a Swan license to be awarded:

- All mandatory requirements must be fulfilled.

- At least 15 points out of the total points requirement must be achieved. Table 20 can be used for calculating the points score.
- Nordic Ecolabelling must have conducted an on-site inspection of the laundry.
- As a general rule, any subcontractors used (laundries/dry cleaners) must be Swan-labelled. Nevertheless a triviality threshold applies, according to which a small proportion of non Swan-labelled subcontractors may be used, although all subcontractors (irrespective of size) must fulfil a number of requirements related to the chemicals used – corresponding to a prohibition against the unwanted substances in requirement O18 – in order to ensure that end users are not exposed to traces of these substances.

To enable the person processing the application to gain a rapid overview of the application and the laundry, certain basic information must be submitted together with the application. Exhibit 6 to the criteria document has been designed with a view to assisting applicants in providing this information.

All requirements relating to consumption are calculated per kg of laundry (excluding re-laundering) based on an annual average and the laundry must specify the distribution in kg excluding re-laundering for each category of textile. The requirements are related to weighed kg.

4.3 Energy and climate (O5, O6, O7, P2, P3)

O6 Energy. Energy consumption during the operational phase (in other words, activities over which the laundry has a direct influence) is very high relative to energy consumption during other parts of the life cycle (Erberle & Möller, 2006; Frederiksen, 2004; Hansen & Holst, 2002; Frydendal, 2001; Schmidt, 2000; Frydendal, 1998; Kalliala, 1997). Schmidt (2000) looked at hand towel rolls from a life cycle perspective, dividing energy consumption up into three phases as follows: (Frydendal; Schmidt & Zeuthen, 2000):

- Production ~ 16%
- Use/operations (washing/drying/disposal) ~ 80%
- Distribution ~ 5%

Thus imposing a requirement on energy consumption during the operational phase is very relevant and, moreover, the energy consumption at a laundry is highly controllable. The potential benefits of imposing energy requirements are also considerable since there are major variations between the energy consumption levels of individual laundries – including for laundering the same types of textiles. This was confirmed by the data compiled from Nordic laundries during the course of our work on this revision. Other investigations into the industry also confirm this, for example Erberle & Möller (2006), who compared the hand towel laundering operations of 32 European laundries (including sites in Denmark and Finland), found major variations (a factor of 3) between the energy consumption levels of individual laundries.

Studies of the energy consumption of a laundry, have found differences in the amount of energy used to wash different types of textiles. For example, Hansen et al. (1998) found that the average oil/gas consumption of a linen laundry is 1.7 – 2.7 kWh/kg textiles, whereas the average for a clothing laundry is somewhat higher, 2.5 – 3.5 kWh/kg of textile.

An analysis conducted in 1998 of the energy consumption of a linen laundry found that total energy consumption broke down as follows (Petersen & Mou, 1998):

- Wash ~ 25%
- Tumble drying ~ 39%
- Rolling ~ 23%
- Other* ~ 12%

It should be noted that this refers to a single laundry within a specific category and accordingly the energy consumption figures cannot be said to be general. Nevertheless, the study does provide a picture of how energy is consumed. In both the rolling and the tumble drying processes the energy used for evaporating water is the dominant factor. Accordingly the amount of water remaining in the textiles after washing will have a direct effect on energy consumption – and thus the use of artificial fibres such as polyester, which does not absorb as much water as other materials, has a beneficial effect on environmental impact (Frydendal, 1998).

In the case of low-temperature washing there is a widely held perception that lower temperatures mean lower energy consumption. However, this is not always the case, as is apparent from Hansen & Holst (2002), which found that the extra chemical consumption entails that energy consumption over the course the life cycle increases. The study also found that the costs of the laundry will be greater. It should be noted, however, that this conclusion is based on a single example involving work clothing, where it was necessary to step up the surfactant substances considerably. This case cannot be said to be general, and with developments in low temperature processes in recent years it must be concluded that washing at lower temperatures offers significant potential for energy savings. This is confirmed in the confidential part of the Erberle & Möller (2006) study, which compares individual laundries in Europe in terms of the laundering of hand towel rolls.

Since, as discussed above, the energy consumption in the washing process makes up only approximately 25% of the overall energy consumption of the laundry, significant - but not outstanding - energy savings can be achieved every time the temperature can be reduced by a few degrees. Replacing old and frequently over-dimensioned boilers and switching to direct gas powered tumblers and washing machines offers significant potential for reducing energy consumption. Here, however, we are typically talking about major investments that may be difficult to implement in an existing laundry.

As well as reducing the temperature, increasing the proportion of non-absorbent fibres in the textiles (e.g. polyester) may also represent a “short cut” to reducing the energy consumption of the laundry (Frydendal, 1998).

*Heating buildings, hot water, trouser presses, leakages from steam pipes etc

In order to allow comparisons to be made between the figures for electricity consumption and fuel consumption as regards the consumption of primary energy, electricity consumption is multiplied by a factor of 2.5. This corresponds to the standard coefficient for electricity used in the EU (EU, 2006) and used by Nordic Ecolabelling in other criteria. The value reflects the fact that because of losses of energy in production and distribution of electricity, the average efficiency is 40% (EU, 2006) – or put more simply, that the electricity producer uses 2.5 kWh of fuel per kWh of electricity supplied.

District heating in laundries

Since the use of district heating by laundries represents only a very small proportion of their total heating requirements and since in principle this use will be confined to offices/personnel areas and not the laundry process itself we have decided to utilise Nordic average values rather than national or network-specific factors.
Moreover, the use of district heating by laundries is limited and does not occur widely. The effect of various factors relating to district heating will in this product group have little impact and the documentation burden for laundries of acquiring national or network-specific values to calculate energy and carbon dioxide factors for district heating would not be justified in terms of any major environmental benefit. With this in mind and given the fact that the laundries have limited scope for influencing the type of district heating that they are able to buy it is recommended that the factors for energy for carbon dioxide emissions in the energy requirements should be based on Nordic average values. Iceland, however, is exempted for the purpose of this calculation and national values will be aplied by laundries using district heating in Iceland.

We have set the following factor values for energy (F_{energy}) for the various textile categories. It should be noted that the increases in stringency are significantly greater than might initially be apparrent apparent since we have also removed the scope for deducting energy consumption for ventilation, illumination and heating.

Textile categories (see Appendix 2)	**F_{energi} [kwh/kg*] Version 2** (**exclusive** ventilation, lighting and heating of premises)	**F_{energi} [kwh/kg*]** (**including** ventilation, lighting and heating of premises)
Work clothes industrial/kitchen/butchering and equivalent use. Kitchen textiles (cloths and towels)	3,15	3.00
Work clothes, institutions/retail/service Shoes	2,70	2.60
Private clothes from households/institutions	(2,70)	3.20
Hotels	1,80	1.65
Restaurants	2,85	2.75
Hospitals/nursing homes	2,60	2.50
Comforters and pillows	3,00	3.00

Mops and offshore mats	1,00	1.00
Other mats	0,90	0.90
Cloth hand towel rolls	1,80	1.75
Industrial wiping cloths	3,10	3.10
Dry cleaning	0,00	0.00
Other	0,90	0.90

The threshold value for energy consumption by the laundry is calculated as a weighted average of the factor values in relation to the type of textiles that the laundry washes, excluding relaundering

$$G_{energy} = \sum [(Proportion)_i * (F_{energy})_i]$$

The energy consumed by the laundry is calculated by adding fuel energy and electricity together, with a factor of 2.5 being applied for electricity as discussed above.

$$A_{energy} = 2.5 \cdot A_{el} + A_{fuel}$$

The requirement that must be fulfilled by the laundries is that the amount of energy used must be lower than the threshold value.

$$A_{energy} \leq G_{energy}$$

G_{energy} is the threshold value for energy consumption at a laundry measured in kWh primary enery per kg textile laundred (excluding rewash). The weighted average of the factor values provides the threshold value for a laundry.
$(F_{energy})i$ is the factor value for energy in kWh primary energy per kg textile laundred (excluding rewash) for the specified textile category i.
Proportion$_i$ is the proportion of textile category i that is delivered. If e.g. a laundry launders 50% hotel textiles and 50% mats, then Proportio$_{hotel}$ = 0.5 og Proportion$_{mats}$ =0.5 whereas for the remaining categories the figure is 0.
*G_{energy} for the example= (0.5*1.80) + (0.5*0.90) = 1.35 kWh primary energy per kg of textile laundred (excluding rewash).*
A_{el} is the quantity of delivered electricity used at the laundry in kWh per kg textile.
A_{fuel} is the quantity of used at the laundry in kWh per kg textile calculated on the basis of energy consumption and the energy factors in Appendix 2.
A_{energy} is the quantity of primary energy used at the laundry in kWh per kg textile.

If the above laundry uses on average 0.10 kg fuel oil and 0.22 kWh electricity per kg textile, then

$$A_{energy} = 2.5 \frac{kWh}{kWh_{delivered}} \cdot 0.22 \frac{kWh_{delivered}}{kg} + 0.10 \frac{\mathrm{kg_{fueloil}}}{\mathrm{kg}} \cdot 11.29 \frac{\mathrm{kWh}}{\mathrm{kgfueloil}} = 1.679 \frac{kWh}{kg}$$

This is more than the laundry's threshold value for energy (G_{energy}) of 1.275 $\frac{kWh}{kg}$, which means that the laundry fails the Nordic Ecolabel requirements for energy.

This requirement must be fulfilled by the individual Nordic Ecolabelled units in a chain.

If the laundry is able to use meters to separate out the following consumption then these will not be included in the calculation of A_{energy}:

- internal wastewater treatment system
- 35%[1] of the energy consumption of VOC afterburners for laundries which launder industrial wiping cloths

[1] The evaluation of Version 2 (Nordic Ecolabelling, 2011) concluded that there was a need to ease the energy requirement for laundries that wash industrial wiping cloths because of their heavy energy needs for treatment technology to reduce emissions of heavy metals, solvents, oil and other problem substances from the laundered cloths. Instead of simply lowering the threshold value itself these laundries have been given the option of deducting a large part of the energy used by VOC strippers. This ensures that only cloth laudries which make an effort to remove emissions of these solvents to the atmosphere will benefit from the reduction in stringency.

- Internal dry cleaning of textiles (note however any separate energy requirements)

Some laundries that wash industrial wiping cloths use a process whereby the air in the entire laundry is extracted and combusted in an afterburner to ensure that VOCs that enter the laundry with the polluted wiping cloths are not released into the environment. This is an energy-intensive process. Nevertheless, waste heat generated in this process can be used for heating washing water and tumble dryers. To take account of this, laundries that launder industrial wiping cloths and that are able to document energy consumption in the afterburner using a separate meter may deduct 35% of the energy consumption of the afterburner.

For the purpose of setting the above energy consumption requirements we have compiled data from some 70 laundries throughout the entire Nordic region – Swan labelled and non-Swan labelled, although the majority already held Swan licences. The figures are confidential and can accordingly not be presented individually in this Background Document. However, the conclusion with regard to energy was clear: there is a significant need to include energy consumption for, for example, ventilation and lighting, in order to ensure that laundries can optimise their energy consumption in this area, since in several cases we found that this was of greater significance than had previously been assumed. At the same time, we found that a need exists to create a differentiated adjustment of the energy requirements for different categories.

In recent years it has become increasingly more common in Denmark for commercial laundries to launder the clothes of older citizens unable to do so themselves. In logistical terms this category is somewhat more demanding for the laundries than ordinary light clothing from commercial customers and is also difficult in terms of laundering processes because of the nonuniform composition of types, colours, material combinations and textile qualities involved. We have therefore found it necessary to separate out this category.

Industry statistics for Denmark for 2011 (DI Service, 2011) show that taken as a whole, between 2008 and 2010, the industry increased its consumption of both electricity and fuel per kg of textiles laundered during the period. Nevertheless, energy consumption by Danish laundries is generally low when compared with the Nordic region as a whole and the increase in Denmark has not meant that we have not seen a need to generally increase the stringency of the requirements applicable to several of the textile categories.

As is apparent from the collected data as shown in the figure below about 60% of the analyzed laundries in the Nordic region would be capable of fulfilling the new energy mandatory requirements in 2011. Looking isolated at the data of 30 laundries without the Ecolabel lisence, about 70% do not meet this criteria.

Moreover, ***Requirement P2*** encourages the laundries to further reduce their energy consumption through the energy and climate points requirements. The same score can be achieved as in Version 2 with regard to the percentage that A_{energy} constitutes of G_{energy}. Nevertheless, the points requirement has been made more stringent because

the value for G_{energy} is lower and the scope for deducting energy consumption has been removed.

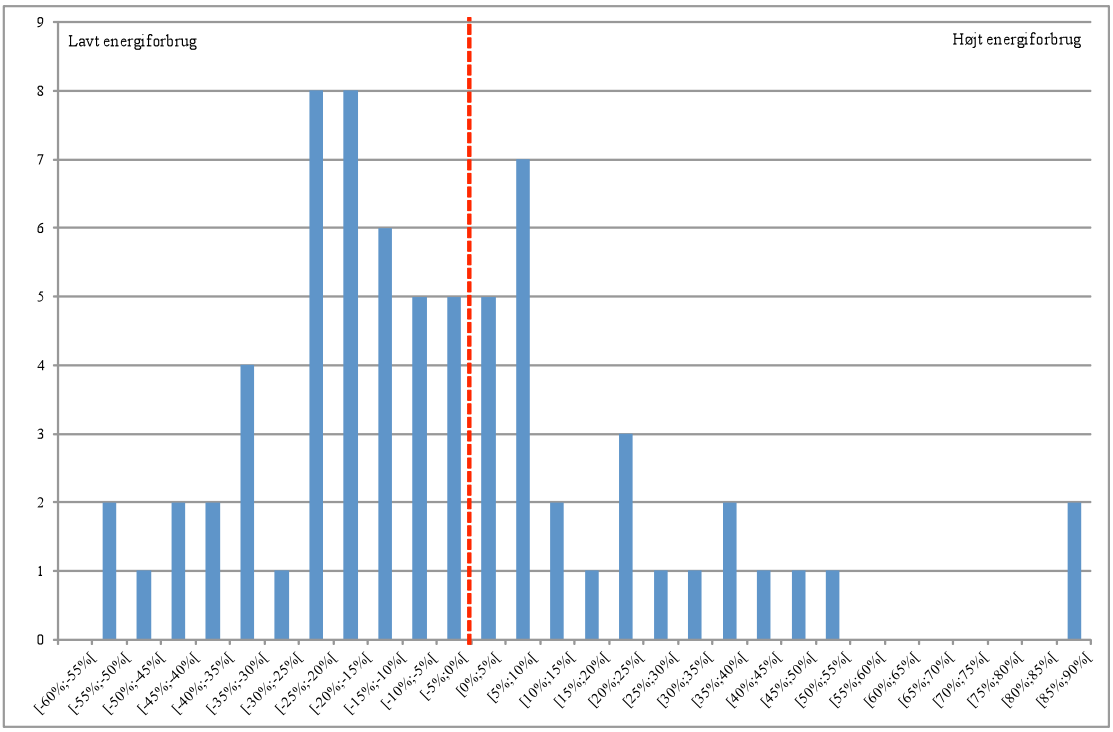

Figure 2. Nordiske vaskeriers relative afvigelse fra vores obligatoriske kravniveau for energiforbrug.

O7 Emissions of climate gases. The energy consumption of the laundries is closely linked to their CO_2 emissions and we have decided to continue to maintain a mandatory threshold value for CO_2 emissions from fuel and electricity consumed by laundries. As in previous versions we have decided against including emissions from "pre-combustion", although in the next revision we expect to be able to introduce general factors for this value based on Nordic Ecolabelling's energy guidelines.

The level of stringency of the requirement has been determined on the basis of the energy requirement, assuming a specific level of electricity consumption (approximately 0.2 kWh/kg) with natural gas as the fuel source. Stated simply this means that typically the CO2 requirement will determine the de facto energy requirement of laundries utilising fuels that are more carbon intensive than natural gas – e.g. oil.

The levels of the requirements are shown below and the calculations are discussed in Appendix 2.

Textile categories (see Appendix 2)	**F_{GWP} [g CO_2e/kg*] Version 2** (**excluding** ventilation, lighting and heating of premises)	**F_{GWP} [g CO_2e/kg*] Version 3** (**including** ventilation, lighting and heating of premises)
Work clothes industrial/kitchen/butchering and equivalent use. Kitchen textiles (cloths and towels)	625	590
Work clothes, institutions/retail/service Shoes	530	510
Private clothes from households/institutions	(530)	670
Hotels	350	310
Restaurants	565	540
Hospitals/nursing homes	510	490
Comforters and pillows	595	590
Mops and offshore mats	185	180
Other mats	165	160
Cloth hand towel rolls	350	330
Industrial wiping cloths	615	610
Dry cleaning	0	0
Other	165	160

The threshold value for climate gases for the laundry is calculated as a weighted average of the factor values relative to the type of textiles washed by the laundry, excluding relaundering.

$$G_{GWP} = \sum [(Proportion)_i * (F_{GWP})_i]$$

The requirement that must be met is that the emissions of climate gases by the laundry must be lower than the threshold value.

$$A_{GWP} \leq G_{GWP}$$

G_{GWP} is the threshold value for climate gas emissions by a laundry measured in g of CO_2 per kg of textile laundered excludingrelaundering. The weighted average of the factor values provides the threshold value for a laundry.
*(F_{GWPi}) is the factor value for climate gases in g of CO_2 per kg of textile laundered, excluding relaundering for the specified textile category i. $Proportion_i$ is the proportion of textile category i that is laundered excluding relaundering. If, for example a laundry washes 50% hotel textiles and 50% other mats, then the $Proportion_{hotel}$ = 0.5 and $Proportion_{mats}$ 0.5, while for the other categories it is 0. In the example G_{GWP} will accordingly be = (0.5*310) + (0,5*160) =235 g of CO_2 per kg textile laundered (excluding relaundering).*
A_{GWP} is the quantity of climate gases emitted per kg of textile calculated on the basis of Appendix 2.

P3 Reduced emissions of climate gases. The stringency of G_{GWP} has now been increased in line with G_{energy} – and accordingly also P3. However, in Version 2 with the criteria it is easier in relative terms to score points for P3 Reduced emissions of climate gases than for P2 Energy. To remedy this, the points requirement has also been made stricter as a result of which a somewhat lower percentage proportion for A_{GWP} needs to be achieved than in Version 2 to achieve the same score.

O5 The sulphur content of fuel. As well as its effects on climate, energy consumption also causes other environmental effects such as acidification and nutrient

loading. Thus a reduction in energy consumption will have a number of beneficial effects for the environment. As regards acidification, fuels containing high levels of sulphur contribute more than other types of fuel. For this reason we impose a further requirement concerning the sulphur content of the fuel used by the laundry of a maximum of 0.1% (w/w). In practice this means that fuels such as coal, coke and heavy fuel oil will be excluded.

The evaluation report suggested that the possibility of imposing requirements on the temperature of wastewater should be considered. However, this cannot easily be controlled by the laundry and is not necessarily an accurate indicator of whether or not energy has been exploited efficiently. Accordingly, maintaining control over total energy consumption (Requirement O6) is a far more effective approach.

4.4 Chemicals and waste water (O10, O11, O12, O13, O14, O15, O16, O17, O18, O19, O23, P7, P8, P9)

Chemicals are one of a number of areas in which the Swan has made and continues to make a major difference. Thus as a result of Nordic Ecolabelling's requirements a number of laundries have phased out various substances harmful to health and the environment and in a number of cases chemical suppliers have even changed the formulations of their standard products in order to meet the Swan requirements, e.g. by excluding CMR substances.

If we look at the calculation of and data on the chemicals used by laundries that already hold a Swan licence we find that it would be possible to increase the stringency of the requirements for most parameters relative to Version 2. However, it is important to bear in mind that the Swan labelled laundries are not representative of the market as a whole and with our information on the changes that the Swan-labelled laundries need to make in order to fulfil the Swan requirements we know that the existing requirements are making a difference. Thus we have several examples of laundries that prior to Swan labelling were many factors above the Swan requirements in terms of, for example, critical dilution volume, substances classified as environmentally harmful and the use of a number of problematical substances not acceptable to Nordic Ecolabelling. We have accordingly concluded that it will not be necessary to increase the stringency of the requirements applicable to the use of chemicals apart from on a limited number of points where it is clear that further potential exists for improvement relative to the current requirements. These are the requirements relating to:

- Phosphorus in the products used
- Chlorine use

A discussion is provided below of the use of chemicals by laundries on the Nordic market and of the various requirements and the reasons underlying these requirements.

It is often a cause of surprise that a laundry will typically purchase a large quantity of laundry chemicals in relation to the quantity of textiles. Thus in 2000, the Sophus Berendsen Group purchased approximately 1,800 tons of textiles, whereas total purchases of laundry chemicals were of the order of 4,300 tons (Berendsen, 2001). Clearly the numbers say nothing directly about environmental relevance, but on the other hand they do indicate that the requirements applicable to the chemicals used by the laundry should carry some weight.

It should be noted that our requirements now cover a larger proportion of the productsused by the laundries, and that this alone means that our requirements have beentightened up relative to previously. At the same time, it is our expectation that theimplementation of new chemical legislation such as REACH and the new EUclassification system (the CLP Regulation*) will mean that more substances andproducts will be classified, in response to which the Nordic Ecolabel requirements will be furtherincreased in stringency.

An industrial laundry uses a variety of different types of chemicals for various purposes (Grüttner, 2008):

- Surfactants
- Complexing agents
- Bleaches
- Rinsing agents
- Other substances, including e.g.
    - Alkalies
    - Enzymes
    - Optical brighteners
    - Fragrance
    - Etc.
    -

Furthermore, new types of substances have become available in recent years – such as substances that allow a high standard of hygiene to be maintained even at lower water temperatures.

Many businesses in the laundry industry have focused attention on phasing out a number of the worst substances – an effort that is supported by amongst others the European industry organisation E.T.S.A. (European Textile Services Association), which has introduced a number of environmental principles, one of which is that: ”Only detergents which have a minimum impact on the environment should be used” (Grüttner, 2008).

In addition to laundry chemicals, laundries may use a wide range of other chemicals such as stain treatment agents and proofing agents, as well as smaller quantities of chemicals that do not come into direct contact with textiles. These might for example be chemicals for cleaning and, if applicable, disinfecting linen trolleys, boiler chemicals, salt and other chemicals for textile soaking equipment as well as lubricants and other substances for maintaining machinery.[2]

*The European Union has adopted a new classification regulation (Classification, Labelling and Packaging) – CLP. The Regulation constitutes a new system for classifying and labelling chemicals within the European Union and applies from 20 January 2009, subject to a transitionary arrangement.

However, the process chemicals are far and away the most significant group and as has already been noted, from a life cycle perspective far more process chemicals (in kilo incl. water) are purchased than textiles. Our requirements accordingly apply exclusively to process chemicals, which we define as chemicals that come into contact with the textiles both before, during and after the wash process. This includes for example stain removal agents, detergents and bleaches, starch, fabric conditioners, proofing agents etc.

The requirements imposed on the chemicals relate both to health and environmental aspects as well as requirements aimed at assuring that there is a low risk to the environment.

At the laundries most of the chemicals are handled in automatic dosing systems, where there is very little risk of direct contact with the chemical. But, for example, when moving suction lances and the like from an empty chemical container to a full container, as well as during manual dosing, there is a greater likelihood of exposure.

The requirement is therefore impose that none of the ingoing substances in laundry chemicals may be classified as carcinogenic, mutagenic or toxic for reproduction (CMR) in accordance with the following risk phrases/hazard classes:

- R40/H351*
- R45/H350
- R46/H340
- R49/H350i
- R60/H360F
- R61/H360D
- R62/H361f
- R63/H361d
- R64/H362
- R68/H341
- Combinations of risk phrases and the combinations H360FD, H361fd, H360Fd, H360Df

* *NTA occuring as an impurity in MGDA og GLDA is exempted from the R40/H351 requirement – see special requirement O18 in the criteria document.*

The above requirements also apply to substances that may shed substances with the above classifications.

Spray products may for example be relevant in connection with stain removal chemicals used to pre-treat stains by direct application to the textiles and may for example contain enzymes that cause allergic reactions as a result of the inhalation of dust and aerosols. In order to avoid exposure to aerosols that might be sensitising if inhaled, none of the ingoing substances in spray products may be classified as sensitising in accordance with the following risk phrases/hazard classifications:

- R42/H334

The Regulations are based on GHS (Globally Harmonised System of Classification and Labelling of Chemicals), adopted by the UN.

At the same time, none of the products used may be classified as:

Classification	Hazard class and risk phrase	**CLP**
Very Toxic	T_x with R26, R27, R28, R39	Acute Toxicity Category 1 H330 Acute Toxicity Category 2, H330 Acute Toxicity Category 1, H310 Acute Toxicity Category 2, H310 Acute Toxicity Category 1, H300 Acute Toxicity Category 2, H300 Specific Target Organ Toxicity after Single Exposure Category 1, H370
Toxic	T with R 23, R24, R25, R39, R48	Acute Toxicity Category 3, H331 Acute Toxicity Category 3, H311 Acute Toxicity Category 3, H301 Specific Target Organ Toxicity after Single Exposure Category 1, H371 Specific Target Organ Toxicity after Repeated Exposure Category 1, H372
Harmful to health*	Xn with R20, R21, R48, R65*** R68	Acute Toxicity Category 4, H332 Acute Toxicity Category 4, H312 Specific Target Organ Toxicity after Single Exposure Category 2, H373*** Germ Cell Mutagenicity Category 1B, H340
Allergenic	Xn with R42** Xi med R43	Respiratory Sensitisation Category 1, H334** Skin Sensitisation Category 1, H317
Carcinogenic	T with R45 (Carc 1 or 2) R49 (Carc 1 or 2) Xn with R40	Carcinogenicity Category 1A, H350 Carcinogenicity Category 1B, H350 Carcinogenicity Category 2, H351
Mutagenic	T with R46 (Mut 1 or Mut2) Xn with R68 (Mut 3)	Germ Cell Mutagenicity Category 1A, H340 Germ Cell Mutagenicity Category 1B, H340 Germ Cell Mutagenicity Category 2, H341
Reprotoxic	T with R60 (Rep 1 or 2), R61, R64 Xn with R62, R63	Reproductive Toxicity Category 1A, H360 Reproductive Toxicity Category 1B, H360 Reproductive Toxicity Category 2, H361

* An exemption applies to products where the classification is the result of the content of oxalic acid (CAS 144-62-7) or peracetic acid (CAS 79-21-0).

** Excluding products where the classification is the result of the content of enzymes.

*** *An exemption applies to stain pre-treatment agents that are applied directly to stains prior to laundering. Pre-treatment applied directly to the stain is considered to be sensible in environmental terms, for which reason these exemptions apply to the classification – for an example see the text box below. It should be noted, however, ref. the comments above, that spray products must not contain substances that are sensitising to the airways. In other words, stain removal agents containing enzymes must be dabbed on, not sprayed.*

R20 Harmful by inhalation
R21 Harmful in contact with skin
R23 Toxic by inhalation
R24 Toxic in contact with skin
R25 Toxic if swallowed
R26 Very toxic by inhalation
R27 Very toxic in contact with skin
R28 Very toxic if swallowed
R33 Danger of cumulative effects
R39 Danger of very serious irreversible effects
R40 Limited evidence of carcinogenic effect
R42 May cause sensitisation by inhalation
R43 May cause sensitisation by skin contact
R45 May cause cancer
R46 May cause heritable genetic damage
R48 Danger of serious damage to health by prolonged exposure
R49 May cause cancer by inhalation
R50 Very toxic to aquatic organisms
R51 Toxic to aquatic organisms
R52 Harmful to aquatic organisms
R53 May cause long-term adverse effects in the aquatic environment
R60 May impair fertility
R61 May cause harm to the unborn child
R62 Possible risk of impaired fertility
R63 Possible risk of harm to the unborn child
R64 May cause harm to breast-fed babies
R65 Harmful: May cause lung damage if swallowed
R68 Possible risk of irreversible effects

H300 Fatal if swallowed. , H301 Toxic if swallowed. , H310 Fatal in contact with skin. , H311 Toxic in contact with skin. , H312 Harmful in contact with skin. , H317 May cause an allergic skin reaction, , H330 Fatal if inhaled . , H331 Toxic if inhaled. , H332 Harmful if inhaled. , H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled. , H340 May cause genetic defects <state route of exposure if it isconclusively proven that no other routes of exposure cause the hazard>. , H341 Suspected of causing genetic defects <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. , H350 May cause cancer <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.
H351 Suspected of causing cancer <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. , H360 May damage fertility or the unborn child <state specific effect if known><state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. H361 Suspected of damaging fertility or the unborn child <state specific effect if known> <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. , H362 May cause harm to breast-fed children., H370 Causes damage to organs <or state all organs affected, if known> <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. , H371 May cause damage to organs <or state all organs affected, if known> <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. , H372 Causes damage to organs <state all organs affected, if Known> through prolonged or repeated exposure <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>. , H373 May cause damage to organs <state all organs affected, if known> through prolonged or repeated exposure <state route of exposure if it is conclusively proven that no other routes of exposure cause the hazard>.

Pre-applied stain removal agents – Background to the classification exemption

The transition from version 1 to version 2 revealed a problem for the laundries in relation to the use of certain types of stain remover classified as health hazards as Xn, R65 - Harmful: May cause lung damage if swallowed. These are stain removers that are used, for instance, on particularly persistent grease and ink stains, stains caused by lipstick and other cosmetics, as well as “burned on” stains. We have discussed the issue with a number of suppliers of chemicals to professional laundries and they have

not been able to come up with suitable alternatives to meet this need in an effective way. Consequently, the alternative is to discard the stained textiles.

Stain removal vs. discarding
To assess what is best in environmental terms, a simple calculation has been performed applying the following realistic assumptions:
Stain on a cotton textile weighing 500 grams, which has spent half of its normal useful life in the laundry. Were the textile to be discarded, 250 grams of cotton textile would have to be manufactured to replace it. This would require a little more than 250 grams of cotton, but for the sake of simplicity, we will use 250 grams as basis for the calculation.

Given an economic allocation between fibres and seeds of 85% and 15%, respectively, the cultivation of cotton will involve the following consumption, based on an average cotton production operation (Frydendal, 2001):

1,525 litres of water
2.5 grams of pesticides
74.5 grams of fertilizer
5.5 MJ of energy

To this must be added energy and chemicals, etc., consumed in the manufacture of the textiles (weaving, wet treatment, etc.).
By way of comparison, only a few drops of stain remover are required to pre-treat a stain, which clearly indicates stain treatment rather than discarding.
The risk that an employee of the laundry will swallow stain remover is assumed to be very low, because when the chemical is used in a professional situation, this will not be in the same area as food is consumed.
As regards the end user's exposure to the chemical, the stain removers in question are intended for application directly on a stain before (re)washing. Consequently, the stain remover will be washed out, which means that the end-user's exposure to the chemical will be reduced to a minimum, with no risk of the end-user actually swallowing it.

Oxalic acid (Xn; R21/22) is used in laundries to remove for example rust stains which are often found on the textiles and cannot be removed in the ordinary washing process. There are no obvious alternatives to oxalic acid (Köcher, 2008), and accordingly this substance has been exempted from the health hazard classification. Were oxalic acid to be prohibited, the quantity of textiles that would have to be disposed of would increase significantly, which is not good for the environment.

Peracetic acid (R10 - O; R7 - Xn; R20/21/22 - C; R35 - N; R50) is produced from a mixture of acetic acid and hydrogen peroxide, is highly reactive and offers the benefit that it bleaches and disinfects at a far lower temperature than hydrogen peroxide alone. Accordingly, in processes using peracetic acid the wash temperature can be reduced, thereby achieving significant energy savings. In order not to reduce the scope of Nordic Ecolabelled laundries for achieving increased energy savings, we have opted to exempt this substance from the classification requirement.

It will be noted that we have not excluded products that are classified only as harmful to health with R22 (harmful if swallowed). This is because the substances are only used professionally at laundries where there are no children present. At the same time, most of the dosages are applied with the aid of automatic dosage systems, as a result of which the risk of exposure by swallowing is minimal.

The environmental problems associated with laundry chemicals are handled by imposing requirements limiting the use of substances that are not readily degradable, requirements as to critical dilution volume (CDV) and by prohibiting a number of problematical substances.

The following substances are accordingly restricted in the chemicals used:

- Substances that are toxic to the environment and at the same time are not readily degradable (R50/53, R51/53 and R52/53) represent a potential problem to the aquatic environment.
- Phosphorus (from phophates and phosphonates) contributes to an increase in nutrient loading in the environment which can contribute to for example algal bloom followed by oxygen deficit. Moreover, phosphorus is a scarce resource
- Non-anaerobically degradable substances are organic substances that under anaerobic conditions fail to break down in the environment and where there is a risk of accumulation.
- Various substances contribute in different ways to potential environmental impact. In order to ensure an overall reduction in impact, we impose requirements on the total Critical Dilution Volume per kilo of textile. Put simply, the critical dilution volume is a concept which calculates the quantity of dilution with clean water required in order for there to be no toxic effects in the environment. However, this is a theoretical value which weights the fate and toxicity of the substances in the environment.

We impose the requirement that all surfactants must be aerobically and anaerobically degradable and also prohibit the following substances:

- Alkylphenol ethoxylates (APEO) and/or alkylphenol derivates (APD) are a group of surfactants that have been proved to cause endocrine disruption. As a result of legislative requirements, the substances have been phased out of most products, although we occasionally encounter them in raw materials, for which reason they are explicitly prohibited in this criteria document.
- LAS (linear alkylbenzene sulphonates) are a group of surfactants that have an anaerobically degradability of 0% and therefore proscribed. The substances are proscribed in the surfactant requirement, but for the sake of clarity we have explicitly excluded them.
- DADMAC (dialkyldimethyl ammonium chloride) are a group of substances with very high ecotoxicity, for which reason the substance is frequently used during the summer by laundries in the final rinse to protect textiles against mildew. Our view is that better production planning would rule out the need to use this type of environmentally harmful substances. DADMAC are proscribed in the surfactant requirement, but for the sake of clarity we have explicitly excluded them.

- Perfluorinated and polyfluorinated alkylated compounds (PFAS) are used for example in connection with the proofing of textiles in or after the wash process. The substances are persistent and are easily discovered in the body (Jensen, Poulsen & Bossi, 2006). The chemical substances in the group affect biological processes in the body and are suspected of both endocrine disruption and carcinogenic properties (Jensen, Poulsen & Bossi, 2006). It is very difficult to find alternatives that are not excluded by our requirements and, since proofing is necessary for certain types of textiles we have only prohibited the use of those PFOS and PFOA substances that are regarded as the most problematical.
- Boric acid and borates. Borates are used in detergents and bleaching agents, and a number of these substances as well as boric acid are in the process of being classified as toxic for reproduction (EU, 2008).
- Optical brighteners make the textiles artificially whiter by lodging in the fibres and reflecting more blue light, so that the textiles look whiter. Experiences from the laundry industry has revealed that optical brighteners are not necessary and that it is only where customers hold textiles laundered with and without optical brightener directly up against each other that they will see that products without optical brightener do not appear quite as white. Optical brighteners must therefore be viewed as unnecessary, and even though in recent years more environmentally-friendly substances have been developed for use as optical brighteners we see no reason to permit the use in Nordic Ecolabelled textile services.
- NTA and its salts are a complexing agent that has been classified as carcinogenic in the first amendment to the CLP Directive (implementation of the Global Harmonisation System i Europe). This substance is explicitly prohibited However, an exemption for NTA as an impurity in certain alternative complexing agents has been introduced, which reflects the practice in Nordic Ecolabel criteria in the chemical/technical area. The producers of the alternatives have documented that alternatives containing NTA as a pollutant in small concentrations are not carcinogenic because in these low concentrations NTA does not form the crystals that are suspected of being carcinogenic.
- Fragrances may contain substances that have effects on both the environment and health. At the same time, the use of fragrance in the washing process may result in involuntary exposure for the end users of the textiles. In addition, fragrance is unnecessary and does not lead to an improved wash result. Accordingly the use of fragrance in products that come into contact with the textiles is prohibited.
- Nanometals, nanocarbon compounds and/or nanofluoride compounds must not be actively added. For this purpose nanoparticles are regarded as microscopic particles where at least one of the dimensions is less than 100 nm. Examples of nanometals include nanosilver, nanogold and nanocopper. Nanometals such as nanosilver and nanocopper are under particularly close observation since they are found in a wide range of products, ranging from socks to refrigerators, in order to achieve an antibacterial effect. Substances such as nanosilver are viewed as biocides by the US Environmental Protection Agency. There is particular concern that emissions of nanosilver to waste water and other

distribution of nanosilver may eliminate wanted bacteria and cause bacterial resistance.

- Triclosan is an antibacterial disinfectant that is used in a wide range of products. There is some concern that the use of antibacterial and disinfectant substances such as triclosan may play a part in increasing the resistance of bacteria to antibiotics (Miljøstatus i Norge, 2008A). Triclosan is bioaccumulable and classified as environmentally harmful - N; R50/53 (Dye et al, 2007) and is on the Norwegian Pollution Control Authority's Priority List – a list of substances that the Norwegian authorities are seeking to bring about a significant reduction in the use of (Miljøstatus i Norge, 2008A) and on the Danish EPA's "Liste over uønskede stoffer " (List of proscribed substances) (EPA, 2004). Studies have been conducted that show that triclosan breaks down into harmful dioxins when it comes into contact with sunlight (Bakke, 2003). Triclosan has been found in a number of different locations – for example in sewage and in waste water from treatment plants (Dye et al, 2007), which indicates that the use of triclosan results in exposure in the environment.
- EDTA is a powerful complexing agent that is capable of binding metal ions and is therefore also suspected of being capable of mobilising heavy metals in the aquatic environment. However, the industry has questioned this latter property (Cefic, 2003). EDTA is not readily degradable and the European Union's risk assessment concludes that conditions in municipal treatment plants are such that EDTA will not break down or will break down only to a limited extent (Cefic, 2002). EDTA was permitted in previous criteria for professional textile detergents (version 1.2) and laundries (version 1.4) in Norway and in other areas where the use of phosphorus has been prohibited. However, more environmetally-friendly alternatives are now available that are degradable and can replace EDTA. These include MGDA (methylglycin diacetic), and for this reason we have chosen to entirely prohibit the use of EDTA.
- "Persistent, bioaccumulable and toxic (PBT) organic substances" and "very persistent and very bioaccumulable (vPvB) organic substances": The inherent properties of these substances should be kept out of the environment and are therefore excluded from the chemicals that may be used in Nordic Ecolabelled textile service operations. PBT and vPvB substances are defined in Annex XIII to REACH (Directive 1907/2006/EC). Substances that fulfil or substances that form other substances that fulfil the PBT or vPvB criteria can be found on the European Chemical Bureau website: http://ecb.jrc.it/esis/index.php?PGM=pbt. Substances that are "deferred" or substances "under evaluation" are not considered to have PBT or vPvB properties.

"Substances of very high concern" (SVHC), i.e. substances classified as Carc. Cat. 1 or 2, Muta. Cat. 1 or 2, Repr. Cat. 1 or 2, PBT or vPvB substances or substances for which scientific evidence exists of a likelihood of serious effects on human health or the environment (e.g. hormone disruptors) are not permitted in laundry chemicals.

Substances on the Candidate List and substances that are expected to be included on the Candidate List upon REACH registration, i.e."Substances of very high concern", are not expected to occur in ecolabelled products since the ECHA defines substances of this nature as substances that are classified as

CMR and substances that fulfil the criteria for PBT and vPvB, which are already excluded in this requirement. However, substances may also be assessed on a case-by-case basis for inclusion on the Candidate List. Based on the precautionary principle Nordic Ecolabelling therefore wishes to include ”Substances of very high concern” in this requirement.

The list can be found by following this link:

http://echa.europa.eu/chem_data/candidate_list_en.asp.

- Substances that cause endocrine disruption are substances that may affect the endocrine balance in humans and animals. Hormones control a number of the body’s processes and are of particular importance in the growth and development of humans, animals and plants. Changes in the hormone/endocrine balance may have undesired effects and attention has in particular been focused on hormones that effect sexual development and reproduction. A number of studies have shown effects on animals which are assumed to have been caused by changes in the hormone balance. Emissions to the aquatic environment are one of the main sources of emissions and the spread of substances that cause endocrine disruption. (Miljøstatus i Norge, 2008B)
- Halogenated flame retardants encompass a range of substances harmful to health and the environment and highly toxic to organisms in water, carcinogenic or harmful to health in other ways. The substances do not break down readily in the environment, which increases the risk of harmful effects (Miljøvejledninger, 2008). Flame retardants may occur in the laundry since flame retardant proofed specialist textiles require frequent regeneration in order to retain their flame retardant properties. This regeneration process is performed by laundries (Glensvig et al., 2005).

Dyes

Dyes can aid in the correct identification of products in the laundries, thereby preventing errors that can result in environment and working environment-related problems. Dyestuffs are therefore permitted, but we impose the requirement that they be either approved for use in foodstuffs or not be bioaccumulable. Dyestuffs are regarded as not bioaccumulable if BCF < 500 or logKow < 4. If both values are available, the actual BCF value measured will be decisive.

Chlorine

In the past many laundries used large quantities of active chlorine compounds such as sodium hypochlorite. Although the level of consumption has now been reduced, our experience of the industry has shown us that many laundries still use bleach in situations in which it is unnecessary or use higher doses than necessary. Active chlorine compounds are in themselves toxic to the environment, but are reactive and accordingly break down. However, their reaction with organic substances can create chloro-organic substances that have undesirable environmental properties. On the other hand the use of bleach can in some cases entail that the quantity of textiles that would otherwise be discarded is reduced. This includes for example textiles with mildew stains that can only be removed by rewashing with chlorine. This is reflected in our threshold values on the use of chlorine for the various textile categories which

are further divided up in order to safeguard that the threshold value as far as possible reflects a genuine need.

We have chosen to impose limits on the overall consumption of active chlorine per kilo of textile delivered (excluding relaundering – note however that chlorine used in relaundering is included in the quantity of chlorine used) instead of, as in the past, looking at the individual washing process and then permitting chlorine to be used only in washing and rewashing heavily soiled textiles. However, the requirements will be imposed in such a way that chlorine will in practice only be used where a genuine need exists – i.e. when washing and rewashing heavily soiled textiles.

The information base available for imposing requirements as to chlorine is not as detailed as in the case of energy and water. We have specific data for some 20 individual laundries and collective data from two major chains: Lindström and De Forenede Dampvaskerier. What we can see from the figures for the individual laundries is that there are major variations in bleach consumption, ranging from 0 mg/kg for laundries washing textiles that do not require the use of chlorine to over 1,000 mg active chlorine/kg of textile in other laundries. Generally we can say in the case of individual laundries on which we have data that those with a valid Nordic Ecolabel use less chlorine than laundries that do not hold Nordic Ecolabel licences.

At Lindström' s laundries an average of 600mg/kg chlorine is used per kg of textiles (Lindström, 2011) . For De Forenede Dampvaskerier we only have older data from 2006 showing that approximately 6.1 g of ”bleach” was used per kg of textile (DFD, 2007), which assuming a level of 13% active chlorine in the bleach essence corresponds to approx. 800mg/kg textile.

Our experience has shown that there is possible to tighten the requirement further, without compromising the washing quality. This means values ar tightened 25% in this proposal versus version 2.

Textile categories		**$F_{chlorine}$ [mg/kg*] (Version 2)**	**$F_{chlorine}$ [mg/kg*] Version 3)**
Work clothes industrial/kitchen/ butchering and equivalent use. Kitchen textiles (cloths and towels)	White workwear from food preparation industry etc.	2000	1500
	Kitchencloths and -towels	2500	1875
	Colored workwear and other textiles	0	0
Work clothes, institutions/retail/service Private clothes from households/institutions Shoes	White	200	150
	Other	0	0
Hotels		150	115
Restaurants	White tablecloths	350	265
	White napkins	2000	1500
	Colored tablelinen and other textiles	0	0
Hospitals/nursing homes	'Blod clothes'	2300	1725
	Other textiles	150	115
Comforters and pillows		0	0
Mops and offshore mats		0	0
Other mats		0	0
Cloth hand towel rolls		25	20
Industrial wiping cloths		0	0
Dry cleaning		0	0
Other		0	0

$$G_{chlorine} = \sum [(Proportion)_i * (F_{chlorine})_i]$$

Requirement

$$A_{chlorine} \leq G_{chlorine}$$

$G_{chlorine}$ is the threshold value for the consumption of active chlorine by a laundry measured in mg of active chlorine per kilo of textile delivered. The weighted average of factor values provides the threshold value for a laundry.
$(F_{chlorine})i$ is the factor value for active chlorine in mg per kg textile delivered for the individual textile category i.
*$Proportion_i$ is the proportion of textile category i that is delivered. If a laundry e.g. launders 50% hotel textiles and 50% mats, then $Proportion_{hotel}$ = 0.5 and $Proportion_{mats}$ 0.5 whereas for the other categories the figure is 0. $G_{Chlorine}$ for the example= (0.5*115.0)+ (0.5*0.0) = 57,5 mg active chlorine per kg of textile (excluding rewash).*
$A_{chlorine}$ is the quantity of active chlorine used by the laundry in mg per kg of textile (excluding rewash).

CDV (critical dilution volume)

The critical dilution volume (CDV) of all chemicals that come into contact with the textiles must be calculated. This will include detergents, bleaches, starch, fabric conditioners, proofing agents and stain removal agents.

The critical dilution volume is a theoretical value that takes account of the toxicity and degradation in the environment of the individual substance. The method was developed for the EU Flower. We give the applicants the choice of calculating either acute or chronic CDV, although there are differences between the level of requirements that will apply depending on the method chosen. Only one method may be chosen by each laundry and thus either acute or chronic SDV will be calculated for all laundry chemicals used by the laundry.

Table 4: Factor values for CDV in various textile categories

Textile categories (see Appendix 1):	**$F_{CDV\ acute}$ [litre/kg]**	**$F_{CDV\ chronic}$ [litre/kg]**
Work clothes, industrial/catering/butchering and kitchen whites	450.000	225.000
Work clothes, institutions/retail/service	350.000	175.000
Hotels	150.000	75.000
Restaurants	250.000	125.000
Hospitals/nursing homes	250.000	125.000
Comforters and pillows	150.000	75.000
Mops and offshore mats	250.000	125.000
Other mats	150.000	75.000
Textile hand towel rolls	150.000	75.000
Industrial wiping cloths	400.000	200.000
Dry cleaning	0	0
Other	150.000	75.000

$$G_{CDV} = \sum [(Proportion)_i * (F_{CDV})_i]$$

Requirements

$$A_{CDV} \leq G_{CDV}$$

G_{CDV} is the threshold value for the critical dilution volume of the chemical consumption calculated in litres per kilo of textile delivered. The weighted average of the factor values provides the threshold values for a laundry.
$(F_{CDV})i$ is the factor value for CDV in litres per kilo of textile delivered for the individual textile category i.
*$Proportion_i$ is the proportion of textile category i that is delivered. If a laundry e.g. launders 50% hotel textiles and 50% mats, then $Proportion_{hotel} = 0.5$ and $Proportion_{mats} = 0.5$ whereas for the other categories the figure is 0. G_{CDV} for the example= (0.5*150,000)+ (0.5*150,000) = 150.000 litres per kg of textile delivered.*
A_{CDV} is the critical dilution volume for the chemicals used in the laundry in litres per kilo of textile delivered.

Because of the degradation of the substances during the washing process, special rules apply to the calculation of the following three substances:

- Active chlorine such as sodium hypochlorite is not included in the calculation of CDV. The substance may well form problematical haloginated organic compounds in the process, and these may well be released into waste water but it would not be controllable to include them in the calculation, and moreover the use of active chlorine is already specifically restricted in other requirements of the criteria document precisely for this reason.
- Hydrogen peroxide – is not included in the calculation of CDV.
- Peracetic acid is included in the calculation as acetic acid.

Although many of the laundries that currently hold Swan licences fulfil these threshold values we have chosen not to increase the level of stringency in the transition from Version 2 to Version 3. This is because we have information indicating that laundries that do not hold Swan licences may be recording values far in excess of these threshold values, for example because of the use of disinfectants for low temperature washes, proofing agents to prevent mildew and the use of fragrances and other substances.

P7 Points requirement CDV. The points requirement for CDV, however, has been made slightly stricter since scoring points has proved to be very easy.

Phosphorus
Phosphorus (P) released into the aquatic environment contributes to nutrient loading which may result in algal bloom and oxygen deficit. If waste water is processed in a treatment plant, some of the phosphorus will be precipitated in the waste water but some will slip through, and we have accordingly imposed the requirement that the use of phosphorus will be reduced.

The evaluation found that the phosphorus requirement was not having any major effect and concluded that the possibility of removing the requirement in its entirety should be considered. However, we have decided against removing the requirement entirely since nutrient loading is not the only problem associated with phosphorus. Attention is increasingly being focused on phosphorus from a resource perspective, phosphorus being regarded as a scarce resource. The level of the requirement stipulated in Version 2 did not have a major effect because an increasing proportion of chemicals are generally supplied free of phosphates. Instead of removing the requirement in its entirety, we have opted to propose that it be tightened up by a factor of 2-3.

Table 5: Factor values for phosphorus in the various textile categories

Textile categories (see Appendix 1):	**F_P [g/kg] (version 2)**	**F_P [g/kg] (version 3)**
Work clothes, industrial/catering/butchering and kitchen whites	1.75	0,60
Work clothes, institutions/retail/service	1.25	0,40
Hotels	0.50	0,25
Restaurants	1,00	0,35
Hospitals/nursing homes	0.75	0,30
Comforters and pillows	0.50	0,25
Mops and offshore mats	0.75	0,35
Other mats	0,50	0,25
Textile hand towel rolls	0.50	0,25
Industrial wiping cloths	1.50	0,50
Dry cleaning	0.00	0,00
Other	0.50	0,25

$$G_P = \sum [(Proportion)_i * (F_P)_i]$$

Requirements

$Ap \leq Gp$

G_P is the threshold value for the use of P by a laundry measured in g P per kg textile delivered. This is the weighted average of factor values, which provides the threshold value for a laundry.
$(F_P)i$ is the factor value for P in g per kg textile delivered for the stated textile category i.
*$Proportion_i$ is the proportion of textile category i that is delivered. If a laundry e.g. launders 50% restaurant textiles and 50% mats, then $Proportion_{restaurant} = 0.5$ and $Proportion_{mats}$ 0.5 whereas for the other categories the figure is 0. GV_P for the example will be = (0.5*0,5)+(0.5*0.25) = 0,25 g-P per kg of textile delivered.*
A_P is the quantity of P used by the laundry in g per kg of textile delivered.

Non-anaerobically degradable substances

We limit the content of organic substances in chemicals that are not anaerobically degradable in order to ensure that the substances released into the environment that are not immediately anaerobically degradable are minimised. The DID uses the term anNBO=Y for substances that are anaerobically degradable.

The threshold has been set slightly higher than the threshold for laundry detergents for professional use, since laundries use more products than users that might been compassed by the criteria for professional laundry detergents. This applies in the case of, for example, proofing agents.*

Table 6: Factor values for non-anaerobically degradable compounds in various textile categories

Textile categories:	**F_{anNBO} [g/kg]**
Work clothes, industrial/catering/butchering and kitchen whites	1.75
Work clothes, institutions/retail/service	1.25
Hotels	0.60
Restaurants	1.10
Hospitals/nursing homes	1.00
Comforters and pillows	0.60
Mops and offshore mats	1.00
Other mats	0.75
Textile hand towel rolls	0.60
Industrial wiping cloths	1.50
Dry cleaning	0.00
Other	0.60

$$G_{anNBO} = \sum [(Proportion)_i * (F_{anNBO})_i]$$

Requirement

$$AanNBO \leq GanNBO$$

G_{anNBO} is the threshold value for the consumption of non-anaerobically degradable organic substances in a laundry measured in g per kg of textile delivered. The weighted average of the factor values provides the threshold value for a laundry.
$(F_{anNBO})i$ is the factor value for non-anaerobically degradable organic substances g per kg of textile delivered for the stated textile category i.

The DID provides information on the anearobic degradability of a number of substances. Substances for which there are no data on anaerobically degradability are as a general rule regarded as non-anaerobically degradable. However, substances that are not surfactants and are aerobically degradable (in accordance with OECD 301A-F or the equivalent), where there are no other data on anaerobical degradability and which fulfil at least one of the following criteria are not included amongst the anaerobically degradable substances:

- *have low adsorption (A < 25%) or high desorption (D > 75%) in accordance with OECD guideline no. 106, or*

- *are not bioaccumulable (bioconcentration factor (BCF) < 100 in accordance with OECD 305 A-E or where data on BCF are not available logKow < 3 in accordance with OECD guide 107, 117 or the equivalent).*

*$Proportion_i$ is the proportion of textile category i that is delivered. If for example a laundry launders 50% restaurant textiles and 40% mats, then $Proportion_{restaurant}$ = 0.,5 and $Proportion_{mats}$ 0.5 whereas for the other categories the figure will be 0. In this example G_{IAN} = (0.5*0.60)+(0.5*0.75) = 0.675 g non-anaerobically degradable organic substances per kg of textiles (excluding rewash).*
A_{IAN} is the applied quantity of non-aerobically degradable orgic substances in the laundry in g per kg of textiles delivered.

The content of environmentally harmful non-readily degradable substances in the chemicals

As well as limiting CDV, we wish to specifically limit the use of substances that are toxic to the aquatic environment and do not degrade readily in the aquatic environment – in other words substances with risk phrases R50/53, R51/53 and R52/53. Since R50/53 substances are more unwanted than substances with e.g. R52/53 classifications, we have included a factor that takes account of this. R50/53 substances may however have a significantly higher toxicity than expressed by the factor, but this will be very rare and is unlikely to apply to the substances that are typically used by a laundry today. The limit has been set on the basis of the limit in Version 1 of the criteria based on an equal distribution between R50/53, R12/53 and R52/53. In practice this means that the requirement has been tightened up for laundries that use a high proportion of the most environmentally harmful group (R50/53), but made less stringent for those with a low proportion of this group.

Requirement:

$$A_{\text{R50/53 or H410}} + \frac{A_{\text{R51/53 or H411}}}{10} + \frac{A_{\text{R52/53 or H412}}}{100} \leq 0{,}013 \text{ g/kg textiles}$$

$A_{R50/53}$ is the applied quantity of substances classified as R50/53in g per kg of textiles delivered
$A_{R51/53}$ is the applied quantity of substances classified as R51/53 in g per kg of textiles delivered
$A_{R52/53}$ is the applied quantity of substances classified as R52/53 in g per kg of textiles delivered

Waste water from laundries

As well as traces of laundry chemicals, waste water also contains soils from the laundered textiles. The content of e.g. heavy metals may have a major significance for the environmental impact of the laundry (Hansen & Holst, 2002).

It will not be controllable to impose requirements as to the content of soils in the textiles washed at customers, but is possible to impose requirements as to e.g. pollution of waste water by the laundries.

Experiences from the industry (Brynjolf, 1999) shows that the highest heavy metal impact is associated with the laundering of work clothes and that the heavy metal content of waste water at laundries that wash work clothes can be reduced by 70-95% by installing a small treatment plant at the laundries which treats the water before it is released to the public sewage system.

In 2001, Sophus Berendsen had pre-treatment plants in 4 out of 20 work clothes laundries, which for the Nordic countries corresponded to 27% af Berendsen's laundering of work clothes in Denmark and 38% in Sweden (Hansen & Holst, 2002). Pre-treatment entails that after treatment the waste water is released into the public waste water treatment plant (Hansen & Holst, 2002).

An analysis of the ecotoxicity of waste water conducted at the Technical University of Denmark before and after pre-treatment with biological treatment at Berendsen's work clothes laundry in Århus revealed a reduction in toxicity to algea of 99.3% and to daphnia of 100% (Hansen & Holst, 2002). No testing on fish was conducted.

The waste water from the laundering of industrial wiping cloths can contain many different problematical substances such a dyes, heavy metals, solvents and oil (Berendsen, 199x), making it inappropriate to release the waste water into the public sewage system (Brynjolf, 1999). Accordingly closed systems, e.g. involving evaporation, may be environmentally beneficial notwithstanding higher energy consumption on waste water treatment. This will depend however on how energy consumption is weighted in relation to water pollution.

Evaporation from solvents in wiping cloths can also constitute a problem in terms of health and the environment, which can be handled in various ways. E.g. the Alba laundry in Denmark collects oil from the cloths and filters it and burns it in its boiler, enabling energy to be used in the washing process (Sørensen, Husmer & Jensen, 2001). At Berendsen, oil and chemicals are micro-filtered and sent to an approved combustion facility (Berendsen, 199x). Here again the energy is used. The atmosphere at a laundry at which industrial wiping cloths are laundered can contain solvents which represent a problem in terms of working environment and safety. This can be resolved by constant extraction and to ensure that the solvents do not reach the environment, some laundries have installed after-burners which burn off the solvents allowing the heat to be recycled (Berendsen, 199x).

We have chosen not to change the wastewater requirements found in Version 2, even though there may be unexploited potential here. This means that the situation will continue to be that only if the total of quantity of industrial wiping cloths laundered exceeds 5%, will the waste water need to be treated in a separate wastewater treatment plant before the sewage and sludge is released by the laundry to the municipal sewage system (Requirement O23). We still do not have sufficient information to define requirements for laundries that launder work clothes since there are major differences between the level of soiling in various types of work clothes – and moreover this may vary from customer to customer. At the same time, the number of laundries which concentrate on work clothes is limited.

Several life cycle assessments of textile services (Erberle & Möller, 2006; Frederiksen, 2004; Hansen & Holst, 2002; Frydendal, 2001; Schmidt, 2000; Frydendal, 1998; Kalliala, 1997) show that the primary environmental impact of the life cycle is connected to the operational phase – more specifically the laundries' processing of the textiles, with a general emphasis on washing and drying.

This is because the textiles are handled multiple times by the laundries (typically up to about 100 wash cycles). The long useful life measured in terms of the number of wash cycles means that the significance of textile production in the life cycle is reduced in comparison to for example everyday and fashion clothing.

In order to secure relevant and comparable environmental requirements, most of our requirements are imposed in relation to the functional unit, i.e. the quantity of

laundered clothes ready to be send out to customers. In practice, this means all laundered clothes less relaundered clothes. However, consumption involved in relaundering must be included for the purpose of our requirements.

Since different textile types require very different kinds of treatment and accordinglyhave different impacts on the environment, we have divided the requirements up intovarious textile categories. The laundries must calculate the quantity of textileslaundered in each category (excluding relaundering) in order to determine the specificlevel of requirements.

There are different ways of determining quantities laundered. The preferred method is automatic registration by means of load cells (either during sorting or in the laundering machines). Not all laundries have this option, and accordingly other methods that provide a true picture may also be used. It may be, for example, that the laundry knows the average weight of the various item numbers and can use this value and the number of items laundered (excluding relaundering) to calculate the quantity laundered in each category.

Key environmental issues from a life cycle perspective include energy consumption and the associated environmental effects such as global warming, acidification, eutrofication etc. and the consumption of chemicals which contributes to, e.g., toxicity for humans and the environment, eutrofication etc. Water consumption may also be a major factor, particularly in regions with few available fresh water reserves.

4.5 Water consumption

Water is used by the laundry every time the textiles are laundered and as a consequence a great deal of water will be used for laundering during the life cycle of a textile item. It is remarkable that it is not the laundry's use of water that dominates. This is because a high proportion of the textiles consist of cotton, cultivation of which requires a great deal of water. Approximately 50% of the world's cotton fields are irrigated (Frydendal, 1998). Water consumption in the irrigation of cotton amounts to more than 7,000 litres per kg of cotton as a global average even if one includes the fields that are not irrigated (Frydendal, 1998). By way of comparison, a laundry uses on average 10 litres of water per kg laundered, which with 100 washes over the life of the textile makes for water consumption of the order of 1,000 litres of water per kg – in other words – somewhat less than in cotton cultivation. It should be noted, however, that not all the textiles handled by a laundry are made of cotton.

In the case of water consumption it would not be feasible to impose requirements on the water consumed in the cultivation of cotton. Cotton is produced by local farmers in numerous regions around the world and is traded on large exchanges. The cotton found in a single piece of textile might typically derive from a wide range of different farmers in several different regions, to ensure a uniform quality.

Nevertheless, water consumption at a laundry is controllable and even though this is not the major contributor to overall water consumption, this still represents consumption of a considerable order. Reducing the water consumption of the laundry

can at the same time offer a number of other benefits, including reduced energy consumption, since less water will need to be heated and it will be easier to recycle the energy in the hot water.

We have therefore opted to impose requirements on the water consumption of the laundry in order to exclude laundries with very high water consumption from the Nordic Ecolabelled scheme. Nevertheless, we do not view water consumption as the most significant environmental parameter for a laundry.

The amount of water required to wash clothing will depend to a large degree on the type of textile in question. With this in mind we have differentiated our requirements. The requirements as to the quality of the wash water in the case of mats will not be great and it will accordingly be easier to recycle the water, thereby achieving savings. However, a comforter, for example, has a large volume that takes up a great deal of space in the drum relative to other textiles, which in turn results in higher water consumption.

Our experience of the evaluation and other data collection activities have shown that there was a need to tighten up the water consumption requirements in relation to Version 2 of the criteria, especially in relation to the categories hospitals/care homes, hand towel rolls and mats . For most of the other categories the stringency of the requirement has been increased by a few percent since the level of the requirement is relatively weak (it is relatively easy to achieve points for P4 Water Consumption).

Textile categories:	**F_{water} [l/kg*] Version 2**	**F_{water} [l/kg*] Version 3**
Work clothes industrial/kitchen/butchering and equivalent use. Kitchen textiles (cloths and towels)	20,0	19,5
Work clothes, institutions/retail/service Shoes	17,0	16,5
Private clothes from households/institutions	(17,0)	17,0
Hotels	10,0	10.0
Restaurants	18,0	17.0
Hospitals/nursing homes	15,0	12.0
Comforters and pillows	25,0	24.0
Mops and offshore mats	8,0	7.0
Other mats	8,0	6.5
Cloth hand towel rolls	12,0	9,5
Industrial wiping cloths	12,0	11.0
Dry cleaning	0,0	0.0
Other	8,0	7.0

$$G_{water} = \sum [(Proportion)_i * (F_{water})_i]$$

Requirement

$$A_{water} \leq G_{water}$$

G_{water} is the threshold value for water consumption at a laundry measured in litres of clean water per kg textile delivered.The weighted average of factor values provides the threshold value for a laundry.
$(F_{water})i$ is the factor value for water in litres of clean water per kg of textile delivered for the individual textile category i. .
$Proportion_i$ is the proportion of textile category i that is delivered. If a laundry e.g. launders 50% hotel textiles 50% mats, then $Proportion_{hotel}$ = 0.5 and $Proportion_{mats}$ 0.5 whereas for the other categories the figure is 0.
*Gwater for the example = (0.5*1.0) + (0.5*6,5) = 8,25 litre clean water per kg of textile delivered.*
A_{water} is the quantity of clean water used at the laundry in litres of clean water per kg textile delivered.

Water consumption covers the total freshwater consumption of the laundry, which means water consumption exclusive of the use of internally recycled water. Where a chain is applying for a common licence number each individual unit in the chain must fulfil the requirement.

In setting the above water consumption requirement data was compiled from more than 70 laundries throughout the Nordic region – both with and without current Swan licences. The figures are confidential and can therefore not be presented in their entirety in this background document, but the figure provides details of the relative deviations of the laundries from our requirements by interval.

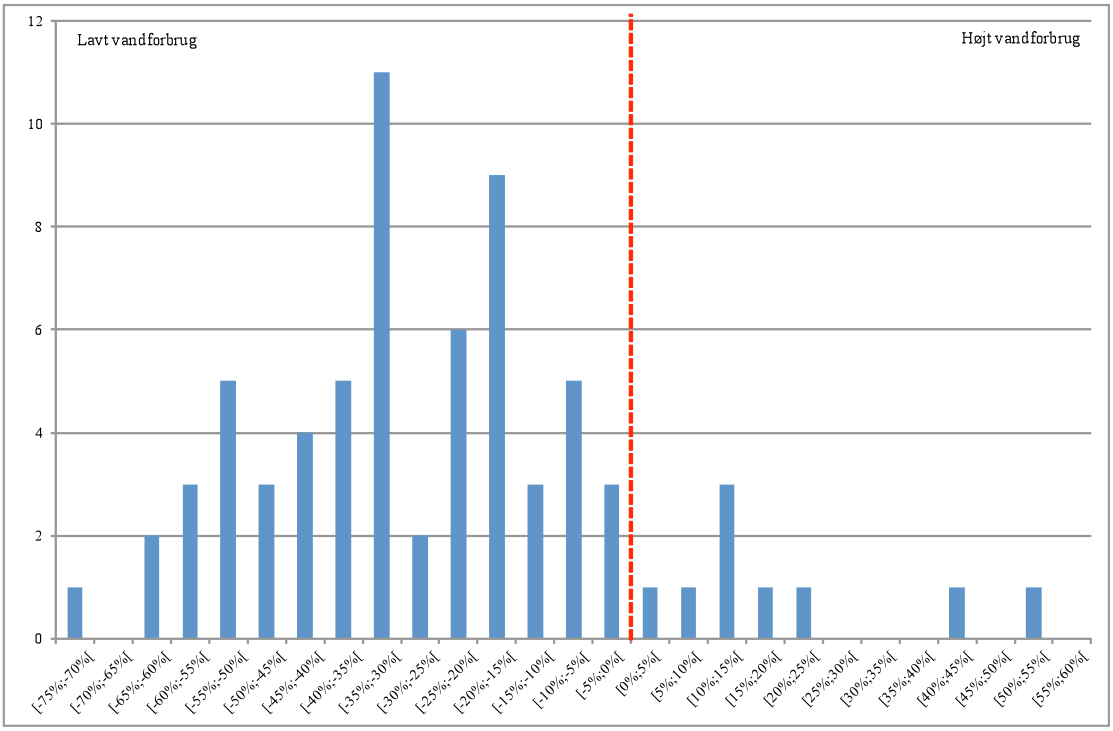

Figure 3. Nordic laundries' relative deviations from our mandatory requirement levels for water consumption.

As will be apparent from the figure, just 10% of the laundries do not meet our water consumption requirements, which fits well with our objectives for water consumption, CF the discussion above. Looking isolated at the data of 30 laundries without the Ecolabel lisence, about 20% do not meet this criteria.

4.6 Rental textiles (O20, O21, O22, P10)

O21 Code of conduct. Industrial laundries usually offer their customers the option of renting textiles, which means that the laundry acquires and owns a high proportion of the textiles that are handled at the laundry and used by the customers. The rest of the textiles are owned by the customers.
Life-cycle assessments of textile services (e.g. Frydendal, 2001) show that the contribution to environmental impact made by textile production is limited when compared with the laundry's consumption of energy and chemicals. Nevertheless it is not insignificant – and with the relocation of textile production to the Far East the significance of working conditions and other similar ethical issues has increased.
We have therefore opted to impose a number of requirements relating to the acquisition of textiles by the laundries. Here the focus has exclusively been on the textiles that the laundries themselves own, since requirements imposed on textiles purchased by customers of the laundries could not be controlled.
The first requirement relates to the enterprise's purchasing policy as regards the acquisition of textiles. Here, Nordic Ecolabelling wishes to play a part in reducing the risk that workers in the textile industry – especially in Third World countries – have to work under unacceptable conditions. For this reason laundries are required to have a code of conduct in place in relation to textile purchases. This code of conduct must require textile suppliers and textile producers to respect and comply with the 10 principles contained in the UN's Global Compact. Alternatively, the code of conduct may be based on working conditions that are consistent with the ILO's eight core conventions.

The ten principles of the UN's Global Compact (United Nations, 2008) are:

<u>Human rights</u>
- Businesses should support and respect the protection of internationally proclaimed human rights; and
- Ensure that they are not complicit in human rights abuses.

<u>Labour Standards</u>
- Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
- The elimination of all forms of forced and compulsory labour;
- The effective abolition of child labour; and
- The elimination of discrimination in respect of employment and occupation.

<u>Environment</u>
- Businesses should support a precautionary approach to environmental challenges;
- Undertake initiatives to promote greater environmental responsibility; and
- Encourage the development and diffusion of environmentally friendly technologies.

<u>Anti-Corruption</u>
- Businesses should work against corruption in all its forms, including extortion and bribery.

The ILO's eight core conventions comprise:

- Prohibition against Child Labour (Conventions 138 and 182)
- Freedom of Association and Protection of the Right to Organise (Conventions 87 and 98)
- Prohibition against Discrimination (Conventions 100 and 111)
- Prohibition against Forced Labour (Conventions 29 and 105).

For further information on Nordic Ecolabelling's stances on ethical issues in textile production please see Nordic Ecolabelling's background document on the Ecolabelling of textiles, skins and leather – Version 4.0.

The textile industry often consists of a complex network of operators. Unfortunately this means that the scope for controlling compliance will in this case be limited. Even so, it is possible to require our licence holders to make a serious effort – and this requirement sends a clear signal of the approach that we wish our licence holders to take.

O22 Disposal/Wastage The production of textiles, including the production of raw materials, has a significant impact on the environment, which means that the focus on textiles and textile waste can have beneficial environmental effects. The production chain for textiles is often complicated, which means that it is difficult to know the full extent of the environmental impact. Most of the textile waste from the laundries that provide Sweden's county council-owned laundry services is sent for incineration. The impact of textiles in waste processing is small relative to the upstream impact of textiles. The reuse of textiles in the same form and for the same purposes as their original use saves energy. However, most important of all, the increased reuse of textiles means that fewer new textiles need to be produced, and this reduces the upstream effect. The greatest obstacle to a reduction in waste quantities has been financial. Producing new textiles in the Far East has been inexpensive when compared with, for example, conducting repairs in the Nordic countries and there is little incentive to increase recycling and minimise consumption (Forslin, 2012). Recently, however, there has been an increase in the price of textiles as a consequence of rising cotton prices and accordingly an increasing number of Norwegian laundries contacted by Nordic Ecolabelling focusing greater attention on minimising textile losses. Textile purchases represent a high proportion of the operating costs of laundries and accordingly a reduction in disposals is desirable.

There are many reasons for disposing of textiles: wear and tear, staining, excessively high repair costs, shrinkage, non-current models. Increased disposal could for example be the result of the unintentional inclusion of an unwanted item in the laundering process (e.g. a ballpoint pen), resulting in discolouration or holes in the textiles (Swedish Standards Institute technical report - "The Textile Handbook"). Wastage should also be considered, since over time this can lead to a reduction in the stock of textiles (Forslin, 2012).

An alternative way of looking at the disposal pattern is based on the following division:

a) disposal as a consequence of textile quality, wear and tear in the laundering process and wear and tear as a result of use of the textiles.
b) Disposal as a consequence of careless/incorrect handling of the textiles – alternatively, wear and tear as a consequence of the use of the textiles for purposes other than those for which they were intended.

To reduce disposals as a result of alternative b above, laundries can step up their efforts to inform users of the importance of correctly handling the textiles (Olaison och Östlund, 2012). One example of this might be the use of tablecloths to mop the floor of a restaurant.

As regards alternative a, the quality of the textiles should be assessed, which can be a challenge. One example of this is that stains can adhere more stubbornly to polyester textiles after they have been through the laundering process thereby becoming difficult to remove, weighed against the fact that polyester does not wear as quickly as cotton (Forslin, 2012). In addition, textiles made of 100% cotton absorb more stains than polyester items. All of these parameters must also be considered against the background of the fact that textile blends (e.g. cotton/polyester) take on a greyish hue at an earlier stage in their useful life than is the case for pure cotton. Ultimately this greying can mean that the customer will not perceive the article to have the expected degree of cleanness (Lindvall, 2012).

The expectations and demands of customers can also impact on the rate of disposal. The ability of a textile service operation to influence customers' choice of textiles will vary.

With a view to gaining a deeper understanding of and insight into the issue of disposal we impose the requirement that laundries must report the total weight of disposals/wastage of textiles that they own.
In addition the laundries must report which categories are disposed of most frequently and the primary reasons for disposal of the main categories must also be stated.

This will provide both the laundries and Nordic Ecolabelling with information on which to assess further goals within this field.

020 Textiles requrement

A second requirement concerns the environmental and health properties of the textiles. There are major differences between the various textile categories in terms of the availability of ecolabelled and health-labelled products. The requirement is therefore related to newly purchased work clothes and linen requiring rolling, since the proportion of products available on the market that can document compliance with ecolabelling criteria or Økotex 100 is somewhat higher than for other categories. However, to offer some benefits in purchasing environmentally and health-friendly textiles – including in other areas – all purchases that comply with the standards, may be included in the calculation. Since ecolabelled textiles are subject to stricter requirements than Økotex, the purchase of ecolabelled textiles will carry a higher weight (by a factor of 3.0). The ecolabelling criteria are life cycle based and, in addition, contain the same requirements as to health and quality concerning the end product as Økotex 100, for which reason an ecolabel is of greater “value” than Økotex

100 and must therefore be allocated a higher weighting. The factor of 3.0 is a subjectively defined factor and is on the same level as the previous version of our criteria.

By ecolabelled textiles we mean textiles that are labelled with either the Nordic Ecolabel or the EU Ecolabel. Bra Miljöval also have criteria for textiles, but they are divided up and cover various aspects of the life cycle of the products. These are fibre production – ”good fibre” – and textile production – ”good preparation” (SNF, 2008). For the labelling to be life cycled-based, the product must be labelled both as ”good fibre” and ”good preparation” and we have therefore decided against crediting this ecolabel for textiles. The situation is different in the case of laundry chemicals.

On an annual basis Nordic Ecolabelled textile services must meet the following requirements:

$$\frac{Quantity_{ecolabelled} \cdot 3{,}0 + Quantity_{Økotex100}}{Quantity_{workclothes} + Quantity_{linen}} \geq 75\%$$

$Quantity_{ecolabelled}$ is the purchased volume (NOK or kg) of ecolabelled products (EU Ecolabel or Nordic Ecolabel)
$Quantity_{Økotex}100$ is the purchased volume (NOK or kg) of products that meet the Økotex100 standard
$Quantity_{work\ clothes}$ is the purchased volume (NOK or kg) of work clothes
$Quantity_{linen}$ is the purchased volume (NOK or kg) of linen requiring rolling (e.g. bedclothes, tableware, hand towel rolls etc.) etc.)

If a business chooses only to ecolabel its hand towel roll service, the purchased quantity of hand towel rolls must meet the requirement – in other words for example at least 75% of the purchased hand towel rolls must fulfil the requirements of Økotex 100.

Since data on purchases will typically be found in the accounting systems of businesses and will not always specify weight, the calculation may be performed on the basis of weight or economic purchase volume, at the discretion of the applicant.

In the case of textile service businesses with a common purchasing division, the textile purchasing requirement may be documented at company level.

4.7 Transport (O9, P5, P6)

Distribution between laundry and customer has less significance in environmental terms than many people might think. A life cycle assessment of hand towel rolls (Schmidt, 2004) shows for example that energy consumption for distribution makes up only 5% of total energy consumption in the life cycle, whereas energy consumption at the laundry makes up 80% (Frydendal, Schmidt & Zeuthen, 2000). One reason for this is that the capacity of the vehicles is typically exploited efficiently because the vehicles are never empty since they carry soiled textiles with them when they return from customers. Nevertheless, transport is of some significance, especially when laundries become more specialised and relocate further away from their customers. However, experience from Denmark has shown that the environmental savings that can be achieved by laundries as a result of specialisation far exceeds the

increased environmental impact that comes with having to transport the textiles further between customer and laundry.A corresponding level of specialisation is increasingly being seen in Norway where, for example, laundry for nursing homes (where high laundry temperatures are required) justifies transportation over larger distances.

Although transport does not represent the greatest environmental impact, it is controllable and very visible to the laundry's customers. At the same time, transport in general represents an increasing problem for society in terms of its impact on health and the environment. Moreover, transport may in some cases – e.g. in the case of mat services – make up a more significant portion of environmental impact because of lower energy consumption at the laundry and a higher level of distribution to small customers.

We have therefore opted to impose a number of requirements on the distribution process between laundry/dry cleaner and customer, even though this is not the primary focus of this criteria document.

Several laundries have outsourced distribution to external carriers (Green, 2000). We have taken account of this when imposing our requirements.

One of these requirements is that all drivers (both in-house and external) driving for the licence-holder must undergo a course (by 3. part) in ecodriving. Newly employed drivers must undergo a course of this nature within 12 months of their employment.

Ecodriving can on average provide fuel savings of between 5 and 10% (Ecodriven, 2006) as well as bringing down emissions of for example CO_2.

When new vehicles are purchased and/or new leasing agreements are signed (both internally and with external transporters) we impose the requirement that the vehicles must as a minimum fulfil the latest EURO norm. At the time of writing this means EURO norm 5 for trucks and EURO norm 4 for goods vehicles and cars (DieselNet, 2008; Wikipedia, 2008). Since new vehicles are required to meet the European Union's most recently adopted norm, the requirement will in practice have been fulfilled as long as new vehicles are purchased. Purchases of second-hand vehicles generally require documentation of compliance with the most recent Euronorm.

Version 2 requires laundries to map the number of kilometres driven and to provide a statement on their fuel consumption. We are expecting the level of the requirement to remain at this level but are considering whether points requirement should be introduced for laundries with low fuel consumption per kg of clothing laundered. This might be an expression of a number of different factors, such as environmentally efficient driving, efficient vehicles and efficient route planning – but also something more general in relation to the distance to customers. All of these factors are relevant from an environmental perspective, although distance to customers will in many cases be difficult to control and comparisons between laundries in major cities and those located in areas with low population levels are difficult.

4.8 Requirement for dry cleaning (O4, P1)

Most laundries have moved away from dry cleaning textiles, although some textiles that cannot be laundered are typically sent to subcontractors for dry cleaning. This is usually a very small proportion, and accordingly limited requirements are imposed as to the dry cleaning process. In the case of laundries that send a higher proportion (>5%) of the processed textiles for dry cleaning (total of dry cleaning internally and by subcontractors) the requirements applicable to alternative dry cleaning of textiles must be met.

If the proportion is lower than this, documentation must be provided that the dry cleaning process is performed without the use of halogenated organic dry cleaning chemicals such as perchloroethylene and other unwanted substances, as discussed in section 0. However, in cases where the quantity is less than 1% it will be necessary only to document that the dry cleaning chemicals do not contain the unwanted substances discussed in section 0.
We have fixed a triviality threshold of 1% below which no specific requirements apply to the dry cleaning process.

Laundries that use Nordic Ecolabelled subcontractors for dry cleaning have further scope for scoring points.

4.9 The processing of waste (O22, O24, O25, O26)

It can be difficult to impose precise requirements with regard to waste since different local authorities have different arrangements for sorting and collecting refuse. Laundry operations do not involve large quantities of solid waste, although sorting waste may nevertheless still be of relevance from an environmental perspective. In order to ensure that the laundries maintain a focus on sorting and minimising waste the laundries must establish a written plan for sorting waste which as a minimum covers paper, cardboard, plastic, textiles (see also O22), environmentally harmful waste, fluorescent tubes and low energy bulbs, batteries and small electrical items. These various fractions must be clearly marked to enable personnel to correctly sort the waste that is generated.

All national rules, including legislation and industry agreements on recycling systems for products and packaging, must be fulfilled in the Nordic countries in which the Nordic Ecolabelled service is marketed.

In order to encourage reductions in plastic packaging and to ensure that recycling takes place, the laundry must offer to take back plastic packaging from its customers and to send it for recycling.

With regard to deliveries of laundry chemicals, all products delivered in quantities in excess of 100 kg must be supplied in returnable packaging, and smaller packaging must be reusable or combustible. Plastic materials must be labelled to ensure correct handling in the recycling process and chlorinated plastics such as PVC must not be present in packaging, including in labels. When PVC is incinerated, certain acid gases are formed, the neutralisation of which involves greater quantities of waste than the quantity of PVC originally incinerated in the incineration plant.

4.10 Environmental management, quality and other requirments (O27, 029, O30, O31, O32, 033, O36, O37, O38)

In order to secure a reasonable level of quality and a satisfactory working environment that exceeds our chemical requirements for the laundry, laundries must as a minimum live up to the quality and working environment requirements of their industry association. In order to ensure that the Swan licence is not exclusive to members of the various national industry associations we also accept compliance with the German standard RAL GZ-992 (Professional Linen Care – Quality Assurance).

This is an important point, since the laundry industry employs a wide variety of nationalities speaking a range of mother tongues. In order to safeguard a good working environment and the fair treatment of employees, laundries must pay production personnel the rates agreed in a collective agreement and must ensure that personnel receive the appropriate training, irrespective of their mother tongue.

An organisation scheme must be submitted on which the central functions are shown and which specifies who has responsibility for the Nordic Ecolabel, environmental work, marketing, information, quality and purchasing. This will help ensure that one single person is responsible for m most primary areas and that Nordic Ecolabelling will know whom to contact in connection with e.g. follow-up inspections of compliance with the Nordic Ecolabel requirements in various areas.

As is the case for all other product groups covered by Swan criteria, planned changes which impact on the Swan requirements must be reported/approved by Nordic Ecolabelling. Unforeseen deviations which impact on the Swan requirements must be reported to Nordic Ecolabelling. This might for example involve planned changes such as changes of chemical suppliers, major production changes (e.g. a change of energy source) or unforeseen errors and deviations such as the delivery of the wrong chemicals or the like.

Al employees and suppliers that in day-to-day operations have a role to play in relation to compliance with the Nordic Ecolabel requirements must be informed of the requirements that concern them in order to ensure compliance with the requirements.

It is therefore important that purchasing procedures be put in place which safeguard that suppliers/subcontractors are aware of the company's environmental policy and the requirements applicable to them. It is also important that all permanent employees involved in day-to-day operations should be in possession of information on the Swan requirements, the environmental policy of the business, its environmental goals and action plan.

In order to ensure that compliance with the Swan requirements is followed up at all times the business must have efficient procedures in place for controlling its own

consumption. This is important in order to enable efficiency to be measured and can also make an important contribution towards discovering for example leakages of water and steam, faults in the dosage systems or other problems with an unintentional high environmental impact. The laundry should therefore as a minimum check its consumption at least once a month (although preferably on a daily basis) and should have procedures in place to check compliance with the Swan requirements as to consumption of energy and water on a monthly basis.

4.11 Points requirements (O28)

In addition to the mandatory requirements the laundry must score at least 15 points for the points requirements. This can be achieved through a significantly lower consumption of energy, water or chemicals or by measures in other areas as discussed above.

Compared to Version 2 it is now somewhat more difficult to achieve these points.

5 Changes since the previous version

The most important changes made in relation to Version 2 are detailed in the following table.

Requirement	Version 2	Version 3
What is required in order to qualify for a Swan Label	Any subcontractors (laundries) used must hold a Swan licence.	*As a general rule, subcontractors of laundry and dry cleaning services must be Swan-labelled. Nevertheless, a small proportion of non-Swan labelled subcontractors may be used provided that they fulfil a number of requirements relating to the chemicals used.* *The quantity of textiles taken in by the laundry and the consumption of laundry chemicals, water and energy on an annual basis must be reported.*
O1 Description of the company and its services		(Somewhat more detailed description)
O2 Allocation between textile categories		”Private clothing ….” becomes separate category
		O3 Subcontractor laundry services: Max 1% non-Swan labelled. Must fulfil O18.

Dry-cleaning	O3 Dry-Cleaning	O4 Dry-Cleaning. Must fulfil O18.
Energy	O5	O6. Deduction for energy for inter alia heating and ventilation not possible. Some increase in stringency of most categories, mostly hotel.
Emissions of climate gases	O6.	O7. Stringency increased in line with energy.
Reduced emissions of climate gases	P3.	P3. Each point level has been reduced by 10% (e.g. from 50 to 40%)
Water consumption	O7	O8. Factor values reduced by small amounts, mostly for hospitals/care homes
CDV		P7 Each point level has been reduced by 10% (e.g. from 50 to 40%)
Chlorine	O13	O14. Factor values reduced by 25% per category
Phosphorus	O14	O15. Significant reduction in factor values
Substances that must not be present in laundry chemical	O17	O18 Potential hormone disruptors + SVHC (Substances of Very High Concern)
Disposals/wastage		O22. Mapping of quantity of discarded textiles, specify main categories and how they are disposed of.
Ethical requirements/working environment		O29. Description of number of employees/substitutes + pay according to collective agreements + training
Knowledge of the Swan requirements	030	O33. + Environmental policy
Energy and CO2 factors		Separate factor for district heating

6 New criteria

The focus areas of the future revision will in principle not be determined until after some years where an evaluation of the requirements is conducted. However, it is expected that there will be continues focus on tightening the requirements on e.g. energy, chemicals and water – depending on the situation and developments in the branch as a whole.

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