About swan-labelled

sanitary products

Background memo to the consultative proposal for the Swan labelling of sanitary products, version 5

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1 Summary

Proposals for new revised environmental requirements for Swan-labelled sanitary products have now been compiled by the Nordic Ecolabelling secretariats. This background memo describes some of the marketing situation for sanitary products, the composition of the products and the background for Nordic Ecolabelling to increasing the stringency in the requirements in the consultative proposal.

Nordic Ecolabeling is of the opinion that the revised criteria in particular will contribute to a reduction in the negative effects on health and the environment related to the production of the products.

One of the main changes proposed in this draft document is that a number of new products now can be swan labelled. In addition to products such as disposable breast pads, diapers, sanitary towels, incontinence care products and tampons, a Swan Label may now be applied for cotton buds, cotton wool, toothpicks, underlays, draw sheets, bed linen, wash cloths and surgical gowns.

The stringency of the requirements governing the production of constituent materials, which generally consist of fluff pulp (cellulose pulp), super-absorbents, cotton, viscose and various plastic materials has been increased considerably in the consultative proposal. The requirements applicable to plastics have been formulated from a resource perspective with a view to stimulating the use of renewable resources and of materials involving low emissions of climate gases. The requirement has been imposed that 7% of plastics must be produced using renewable raw materials or that emissions of climate gases generated during the production of monomers and the polymerisation of plastic materials based on fossil raw materials must be less than 1.5 kg CO_2 equivalents per kg of sanitary product.

Health has been a particular focus of attention during the revision process, and the requirements applicable to substances that may be added to sanitary products during production in the form of chemicals, adhesives, fragrance, lotion, dyestuffs and ink etc. have been tightened up considerably.

2 Introduction

This background memo has been drafted for use during the consultative process for the criteria for the Swan-labelling of sanitary products, version 5. The document provides background information on the product group and the requirements imposed by Nordic Ecolabelling. The requirements were revised in 2006/2007, and supersede those contained in criteria version 4, which was an amalgamation of the criteria for "Ecolabelling of disposable diapers, version 3.2" and "Ecolabelling of female sanitary products, version 1.4".

The Swan-labelling of sanitary products, version 4, was evaluated in 2005/2006. The evaluation report recommended that the criteria document be given a new layout and that two of the requirements in particular be clarified. These recommendations were followed and on 23 March 2006 the layout of the criteria document was adjusted and

the document was translated into Norwegian. Moreover the polyester requirement was removed and greater detail was added to the requirements applicable to PE/PP, SAP, non-woven and cellulose pulp. Breast pads were included in the product group. The original validity date of the criteria was until 27 March 2008 and the document was allocated version No. 4.5. Since then the validity data has been extended and the criteria will now remain in force until 31 December 2008.

The evaluation also recommended a revision whereby the product group would be extended to include other products made of the same types of materials (paper pulp, super-absorbents, viscose, cotton and various types of plastic). A review of the individual requirements was also recommended. The retention of the general disposition of the document with a division into material requirements, product requirements and function requirements was recommended. The plastics requirement in particular should be assessed, and the extension of the product group necessitates the introduction of requirements applicable to new plastic materials.

The revision work was conducted in 2006 and 2007. During the revision process contact with the industry generally took the form of contact with manufacturers of diapers and incontinence care products as well as with suppliers and trade associations for plastics manufacturers. The fluff pulp requirements are based on the work conducted by the paper group during the development of module criteria for the Swan-labelling of paper products.

3 The markets in the Nordic countries

3.1 Sales figures

Table 1 shows sales figures for various sanitary products. The figures are taken from the background memo drafted in 2001, except the figures for Sweden and Finland, which are from 2005 and 2006. In the case of Sweden and Finland the oldest figures are shown in brackets. The table shows that there has been relatively little change in sales figures, and accordingly resources have not been expended on securing updated figures from the other countries.

Table 1. Sale figures for sanitary products in the Nordic countries in millions of items. The figures are primarily pre 2001, but in the case of Sweden and Finland more recent data have been included. The oldest figures are provided in brackets.

Country/Product	**Diapers**	**Sanitary towels**	**Incontinence care products**	**Tampons**
Sweden[a]	410 (428)	240 (237)	220 (225)	120 (149)
Denmark[b]	-	570	-	9
Finland[c]	225 (250)	261 (215)	-	41 (40)
Iceland	-	-	-	-
Norway[d]	240	260	-	50

a) SIS Miljömärkning, February 2005.
b) Statbank Denmark, 1997 figures taken from the Background Memo for Sanitary Products, Version 4.
c) AC, Nielsen, Finland Oy 2006
d) Ecolabelling Norway 2000, data taken from the Background Memo for Sanitary Products, Version 4.

Clearly, the use of sanitary products to vary depending on the age of the population. Diapers and incontinence care products have become more efficient because of the use of super-absorbents as a partial replacement for paper pulp in the products. Although this has not been documented in detail, it would appear that there are more products available on the market and that the products are designed to be used more frequently.

In relative terms, sales of tampons are highest in Swe

3.2 The manufacturers

Swedish-owned SCA[1] is one of the largest multinational manufacturers of tissue and sanitary products. The firm is the third largest in Europe in the area of female sanitary products (including the brands Libresse and Saba) and is a major manufacturer of incontinence care products and hospital/care home articles such as undersheets (Tena). SCA is the leading manufacturer of tissue in Europe. The firm's Libero diaper brand[2] has a 55% share of the Swedish market. SCA also manufacturers ob tampons for Johnson & Johnson. The firm has a 9% share of the European market for female sanitary products and a 15% share of the diaper market.

Procter & Gamble (P & G)[3] is one of the world's largest consumer products manufacturing groups and also has a large share of the Nordic market. Their brands include Always and Alldays sanitary towels and Tampax tampons. The firm's diaper brand Pampers has a 35% of the share of the market in Sweden.

Delipap is the largest manufacturers of sanitary products in Finland. The firm's product range includes diapers, incontinence care products, sanitary towels and breast pads. Delipap has a large share of the market for sanitary towels in Finland with the brands Vuokkoset, Helmi, Harmony and Luxus Muumi. The bulk of production is of own brands, but the firm also has extensive private label production.

Rostam[4], an Israeli producer, produces tampons for the large chains, including for pharmacies in Sweden.

The Ellen tampon brand is sold through RFSU AB. This is a patented Swedish-developed tampon to which lactic acid bacteria have been added. Ellen holds a European patent on a production process in which freeze-dried lactic acid bacteria are protected by means of a water-repellent film. When the tampons are used, the bacteria are brought to life by the body's moisture[5]. The tampons are manufacturer in Slovenia and are sold through national distributors, Norwegian and Swedish Apotek and ICA and ETOS[6].

Kimberly-Clark[7] is one of the world's largest sanitary product manufacturing groups. The group produces female sanitary products and incontinence care products as well as Huggies diapers, which have recently been launched on the Norwegian market. Kimperly-Clark also produces disposable potty training pants (Pull-ups) as well as Little Swimmers, which are disposable swimming pants. The diapers are available on both the Norwegian and the Danish markets.

Abena[8] of Denmark produces a range of products including diapers, incontinence care products, sanitary towels, draw sheets and undersheets in Denmark, Sweden, France

and Germany. Abena produces products for hospitals, institutions and products for the consumers marked (primarily private label products).

Novacare is a French manufacturer of sanitary products.

In addition to the above there are also a number of other manufacturers of sanitary products, many of which produce for the private brands of chains or wholesalers. Kronosept is a Swedish manufacturer of sanitary towels and also sells machines for the production of sanitary products[9]. Swedish manufacturer Dambi produces sanitary products such as sanitary towels and breast pads, 95% of which are for private labels[10].

Other manufacturers emphasise the use of natural materials, for example Natracare[11] in the UK. Their products are sold through health food shops in Norway and include tampons, sanitary towels and panty liners. Moltex Øko[12] of Germany produces diapers and insert pads for children. The firm stresses that its products do not contain additives such as lotion, fragrance etc. The cores of the diapers contain tea leaves, which the manufacturer claims reduce smell and protect the skin as the leaves contain cell regenerating agents, including vitamins A, C and E. In Norway the diapers are sold through health food shops.

Naty AB is a Swedish manufacturer of natural diapers and sanitary products[13] (Nature boy & girl diapers). The products are made of 70% renewable materials and in the past carried the Good Environmental Choice ecolabel[14]. They are based on a patented Swedish invention and instead of plastic contain a compostable biological maize film that breaths. According to the company's website the products are on sale in England, The Netherlands, Australia and Belgium.

According to the Cellcomb[15] website, the company is one of Europe's leading manufacturers of disposable products for the health service, care for the elderly and the sanitary products market. The company's products include 2 and 3-layer laminates of fluffpulp, non-woven, PE and a biopolymer based on starch. Some of the products are described as wholly compostable. The company produces surgical textiles, undersheets, bed linen, protective sheets and sanitary products. Cellcomb is based in Karlstad in Sweden.

Mölnlycke Health Care[16] is another major manufacturer of disposable surgical gowns and surgical drapes for use in operations. The company is headquartered in Gothenburg.

Espe produkter[28] sells laminated and unlaminated products like disposable sheets, bed linen, draw sheets, towels and wash cloths.

Producers and retailers of toothpicks on the Nordic marked are among others Jordan (Norwegian producer), Dentaco As and Zendium.

3.3 Market conditions

Figure 1 shows the relationship between the various elements in the supply chain. The markets of the Nordic countries are generally organised in this way.

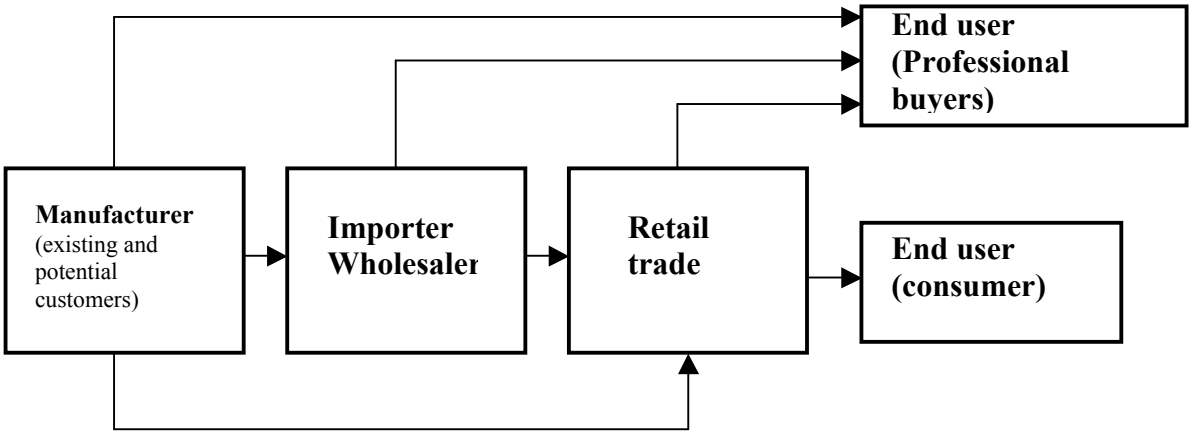

Figure 1: *Typical supply chain and alternative relationships between the individual elements*

To date, the major manufacturers such as SCA and Procter & Gamble have not wished to Swan-label their own brand goods, e.g. diapers. The manufacturers are of the view that there is not sufficient demand amongst consumers for Swan-labelled products, and retail outlets are increasingly focusing on two categories of products: well-known quality products and low cost products. In retail outlets Swan-labelled diapers are often sold under separate brands and the retail trade determines whether a product should be Swan-labelled. In Denmark ecolabelled diapers are cheaper than the major brands Pampers and Libero (2005). The standard price for ecolabelled diapers is approximately DKK 80-90, whereas Libero and Pampers diapers are normally priced in the region of DKK 160-170 for the same package size. Diapers are often sold on special offer, and many chains use diaper prices to attract customers. For example Kiwi, a supermarket chain in Norway, has a diaper contract where every fourth packet of Libero diapers is free. The view of one of the supermarket chains is that in terms of importance for consumers tissue ranks highest, followed by diapers and then female sanitary products.

With some exceptions, environmental factors do not appear to be of major importance to buyers of sanitary products in retail outlets in the Nordic countries (2005). Consumers appear to regard price as the most important factor and health arguments are often ascribed greater weight than environmental issues. One survey of "light green" consumers in Denmark found that these consumers are interested in products that are beneficial environmental terms, and in Sweden the environmental director of Apoteket says that the chain is not unfavourably disposed towards ecolabelling, but that more emphasis is placed on quality and health aspects.

Sales to consumers via retail outlets are dominated by the major supermarket chains, which also form part of international groups. In Sweden pharmacies have a relatively high share of the market. Most of the products sold are Apoteket's own brand and their tampons are Swan-labelled. Other retail outlets include clothes chains such as H&M and health food stores.

The potential for increasing the number of ecolabelled products on the professional market is considered to be great since only a small proportion of products on this

market are ecolabelled at present and environmental awareness amongst buyers is increasing. In this segment, too, the market for sanitary products is growing.

4 The impact of sanitary products on the environment

4.1 Disposable products

The discussion about which is better for the environment, reusable products or disposable products, has been ongoing for many years. Nevertheless, it is a fact that in the case of diapers and sanitary products for consumers and for use in the health service the use of disposable products is widespread. One of the earliest stages in the development of modern disposable diapers probably took place in Sweden at the Paulistrom factory, which between 1936 and 1942 developed several types of diapers made of layered and bleached creped tissue inside rubber pants. The motivation for this may have been that cotton was a strategic material during the war. During the ensuing years there has been a gradual development in diaper design from rectangular inserts for mesh pants or triangular plastic sections that were tied round the child to hold the diaper in place to today's tailored "up-and-go" diapers. Super-absorbents (SAP) were introduced in the 1980s[23].

Numerous studies and life cycle analyses have been conducted with a view to determining whether textile diapers are better than disposable diapers or vice versa. The most recent, the UK Environmental Agency's "Life Cycle Assessment of Disposable and Reusable Nappies in the UK[17]" from 2005, concludes that there is no significant difference between the environmental impact of the three diaper systems that were studied: disposable diapers, textile diapers washed at home and textile diapers with a laundry collection system. The report contains recommendations aimed at reducing the environmental impact of all three systems.

For tampons there are products with and without applicators, and the sale of tampons with applicators varies from country to country. Tampax makes products with applicators made of cardboard or plastic[18].

One of the greatest problems associated with disposable products is the large quantity of waste that they generate. More information on this is provided in Chapter 4.5 Waste . Several types of compostable diapers have been launched, but do not appear to have been available in the Nordic countries. A firm known as Knowaste[19] has launched a technology designed to separate incontinence care products and diapers and recycles both paper and plastic material. The firm's European facility in The Netherlands has been operating since 1999, receiving hygiene products from health institutions. Some local authorities collect used diapers together with wet organic waste for composting[20].

4.2 The composition of the products

According to the background memo developed for the last version of the criteria, the main environmental impact from the use of disposable sanitary products derives from the production of the raw materials used in the products. In the case of disposable diapers some 80% of the energy consumed derives from the production of raw materials. Moreover approximately 60% of water consumption and 80% of water pollution in diaper production relates to the production of raw materials[21]. The UK

LCA study on diapers[17] shows that the production of raw materials remains the primary cause of the environmental problems together with the production of electricity for manufacturing the diapers. The waste processing of disposable diapers after use is a major source of methane emissions and is the dominant waste processing stage in the life cycle of a diaper.

The combination of raw materials used will depend on the type of sanitary product in question, and many of the products contain the same raw materials but in different proportions. One exception is tampons, where the main product is cotton. Table 2 describes the normal composition of diapers.

Table 2. Combination of raw materials used in diapers and incontinence care products expressed as a percentage of the total weight of the product (average figures). The figures are taken from a UK LCA study, from the European Disposables and Nonwovens Association and the Finnish VTT Research Institute. The year refers to the year in which the figures were produced, not the year of publication of the reports.

Raw material	**EDANA diapers 1996**	**VTT[22] 1993**	**EDANA[23] diapers 2001**	**UK diapers[17] 2001/2002**	**EDANA[24] diapers 2004**	**EDANA[24] incontinence diapers 2004**
Fluff pulp	60	69	60	43	43	59
SAP	15	9	27	28	27	14
PP	11	15	10	15	15	9
PE	7	7	13	8	7	10
Adhesive				3	3	4
Elastic				0,5	1	1
Other	7		7	3,1	4	3

Table 2 shows that the trend over the last ten years has been in the direction of a lower fluff pulp content in diapers. However, fluff pulp cannot be excluded entirely, because this material plays an important role in transporting the fluid away from the surface and distributing it throughout the product. Sanitary products have also become thinner, lighter and more efficient[24]. The EDANA figures from 2004 show that incontinence care products contain more fluff pulp than SAP, see Table 2. Diapers and sanitary towels also fit the shape of the body more closely than in the past and follow trends in fashion (e.g. for G-string undergarments). The ratio of SAP to fluff pulp is different in the case of sanitary towels since they are designed primarily to absorb blood, not urine. We have not succeeded in ascertaining the percentage composition of these products, although here too there has been a major shift in the direction of thinner products.

A comparative LCA assessment of sanitary pads and tampons[25] found that the pads contain 60% fluff pulp with super-absorbents, although the quantity of the individual components is not specified. The report was a group study conducted by a course on life cycle analyses at the Royal Institute of Technology in Stockholm and concluded that tampons represent a more environmentally friendly alternative, mainly because of the negative contribution from PE in the sanitary pads. The report contains clear flow charts over the production of the products.

The British LCA study[17] of diapers assessed the environmental factors: resource depletion, climate effect, degradation of stratospheric ozone, human toxicity, acidification, fresh water toxicity, terrestrial toxicity, photochemical ozone formation (smog) and eutrophication, whereas noise, biodiversity, and the tying up of land were

excluded. The study revealed that the contribution made by the production of SAP represents the greatest source of environmental impact in the production of disposable diapers. The contribution made by fluff pulp was not regarded as as significant as had been expected, given the quantity contained in the products.

This document does not describe the environmental impact deriving from the production of fluff pulp since this is described in detail in the background memo to the Swan-labelling criteria for paper products[26]. The criteria documents for "The Swan-labelling of Paper Products — Version 1" and "The Swan-labelling of Paper Products — Chemical module, Version 1" include requirements relating to the production of fluff pulp and impose requirements as to wood fibre, chemical use, emissions to water and air and energy consumption. These documents emphasise requirements designed to result in reduced environmental impact from forestry operations and in the production of the fluff pulp. The requirements entail that special account must be taken of biodiversity in forestry operations, reduced spread of environmental toxins, reduced impact of emissions resulting in acidification, nutrient transfers to water and reduced emissions of climate gases.

Sanitary products contain one or more layers of non-woven. This may consist of viscose, polyester (PET) or PP. Neither the British LCA study[21] nor the most recent EDANA report[23] mentions viscose. One reason for this may be that newer production methods for non-woven made of PP and PET create the same cotton-like feeling that viscose products have traditionally been known for. In the production of non-woven, short fibres form a "sheet" which is then bound together by mechanical means (e.g. needle or water jets), with the aid of adhesives or thermally after the addition of a binding agent that melts at high temperatures. An additive known as "spin-finish" is used in the production of non-woven. This is an organic chemical that serves, inter alia, to prevent static electricity.

Other disposable products such as disposable bed linen, bed underlays and draw sheets, surgical gowns and diaper inserts contain one or more of the same materials as diapers, incontinence care products and sanitary pads. Bed underlays may for example consist of several layers of cellulose, non-woven and a plastic coating. In addition they may contain fluff pulp that increases absorption. The product information on some products states that they feature seams that are sufficiently strong for patients to be lifted and that their edges are sealed with paraffin and thus secured against leakages[27]. The plastic film may for example be of polyethylene (PE) or be a biobased plastic film[28] and prevents moisture from penetrating through the products. One producer [28] sells laminated and unlaminated products made either of non-woven viscose, which is compostable, or of polypropylene (PP), which they claim becomes a recyclable product even with a biofilm lamination. Plastic laminate film is applied to non-woven either with the aid of adhesive (water-based dispersion adhesive or hot-smelt glue or by extruding the plastic film directly. Use of non-woven products has increased in recent years – particularly in the health sector – at the expense of cotton/polyester products. A number of different types of disposable bedclothes are available on the marked made of e.g. non-woven PP-fibre.

One of the best known biobased plastic films is MATER – BI produced by Novamont of Italy. This is a biodegradable thermoplastic made from natural components (such as maize starch and vegetable oil derivatives) and biodegradable synthetic polyester[29].

The material is certified as biodegradable and compostable, but is not, as we have seen, produced using 100% renewable sources.

The European organisation for bioplastics (European Bioplastics) defines bioplastics in the following way[30]:

- Plastics based on renewable resources
- Biodegradable polymers which meet all criteria of scientifically recognised norms for biodegradability and compostability of plastics and plastic products. In Europe this is the EN 13432.

A life cycle analysis of surgical gowns for wet operations (specialist gowns)[31] concludes that the environmental impact of multiple use gowns is less than that of the equivalent disposable products. The materials used in the gowns are shown in Table 3. Both products contain the same quantities of polyester, but this is where the similarities end. Neither of the gowns contains biopolymers. The disposable gown also contains viscose, cellulose, PE and 1% other plastic materials. The main material in the multiple-use gown is "Gore Surgical Barrier", which is a membrane based on polytetrafluorethylene (PTFE) produced by DuPont (Teflon). This material also accounts for the multiple use gown's contribution to ozone degradation. This is the only environmental parameter in the study in which the disposable gown has less of an environmental impact than the multiple use gown.

Table 3. Composition of materials in surgical gowns[31] expressed as percentages.

Raw material	**Disposable**	**Multiple use**
Polyester	40	42
Viscose	2	0
Cellulose	45	0
PE	12	0
Other plastic materials (PP and PA)	1	0
Stainless steel (press studs)	0	1
Gore Surgical Barrier	0	57
Total grams	**220g**	**344g**

The LCA study of surgical gowns considered fewer environmental factors than the British LCA study of diapers and looked at: climate effect, degradation of stratospheric ozone, acidification, eutrophication and photochemical ozone formation. The study does not appear to have included the effects of e.g. chemicals and biodiversity.

A similar disposable product is disposable liners for washable diapers. These liners may be made of paper or non-woven. Naturebotts, which sells these products on the Internet, claims that the products are both compostable and can be disposed of in the toilet[32]. They are made of 98% paper and 2% viscose. Diaper liners allow any faeces to be removed without difficulty so that the textile diaper that is to be washed will not need separate cleaning even if they are left for a time before being laundered. Many people also find it more hygienic to use nappy liners. However, water and sewage organisations in the Nordic countries (such as NORVAR in Norway and Svenskt Vatten in Sweden) remain sceptical about the idea of flushing a product like a diaper liner down the toilet[33]. Development work is ongoing on a test method to determine whether products can be dissolve in the sewage system. However, before

this test has been developed, it will be difficult to have quality requirements showing that it is acceptable to flush diaper liners down the toilet.

Disposable breast pads may consist of pure cotton, or an equivalent combination of materials to that contained in diapers and sanitary pads, i.e. fluff pulp, non-woven and with or without SAP.

As has already been noted, the main material used in tampons is cotton, and there may also be a type of non-woven around the tampon. The string in the product may be made of cotton, PET or viscose. Some tampons also have an applicator, which in the case of Tampax used to be made of cardboard, but is now made of plastic. An applicator of this type weighs just as much as the tampon itself[34]. SAP does not appear to be used in tampons any longer. This can be attributed primarily to toxic shock syndrome (TSS) which is a serious bacterial illness. Several websites state that the risk of TSS can be reduced by using less absorbent tampons[35]. Most tampons are individually packaged inside a thin plastic film or cellophane.

Cotton buds and cotton wool are made of the same materials as tampons. The sticks in cotton buds may be made of wood, plastic or board. The weight of the stick can be up to 2 – 3 times the weight of the cotton[34]. Toothpicks are generally made of wood materials and the product was included because it is a disposable sanitary product and the criteria include requirements as to wooden materials. The revision process did not include any specific investigations into toothpicks and comments from the consultative bodies may determine whether or not toothpicks should be included in the criteria for Swan-labelling.

Other constituent substances mentioned in the British diaper study apart from the primary materials noted above are adhesive, calcium carbonate, tape, elastic and lotion. Some tampons have lactic acid bacteria additives and some diapers feature tea leaves to counteract rashes. Incontinence care products in particular may contain odour retardants, such as active charcoal, zeolites, cyclodextrin etc. According to a patent on Procter & Gamble's website[36] cyclodextrin can function as a suitable matrix for fragrance and the fragrance will only become active when the cyclodextrin is wetted. Cyclodextrin is a cyclical oligosacharide that can be produced from food starch.

Toothpicks are primarily made of wood, but plastic toothpicks are also on sale. Many types are added taste like mint.

Disposable wash cloths made of pure plastic products, for example polyurethane, were considered during the revision process, but have not been included in the product group in this revision. Gloves made solely of plastics such as polyethylene, PVC, latex, nitrile or the like have not been assessed and will therefore not be included in the product group.

4.3 End production of sanitary products

As has already been noted, the British LCA study found that one of the primary causes of environmental impact is the generation of electricity for use in the

production of the diapers. Production itself involves putting together the materials to create a diaper and is a fully automated process where the diaper is packed at the end of the production line. The fluff pulp that is used is often mechanically fluffed up at the factory. Presumably the production process for other sanitary products is similar.

4.4 Packaging

The primary packaging around diapers commonly contains several products, e.g. PE and board. In the case of other sanitary products, such as tampons and sanitary pads, the individual product items may also be wrapped before they are packed in their outer packaging. Stretch plastic, wooden boxes and metal wire are frequently used in transport packaging.

According to the British LCA study a child of diaper age will use diapers weighing 170 kg over a space of two and a half years. A total of 230 kg of materials will be used in producing the diapers, and 7.43 kg of PE and 5.8 kg of board will be used in the primary packaging.

4.5 Waste

Table 4 contains an overview of waste processing of household waste in the various Nordic countries expressed as percentages. Waste quantities may vary from country to country, and accordingly the figures are intended to provide a general impression of the situation.

Table 4. Overview of waste processing in the Nordic countries.

Disposal	**Iceland[37] 1997**	**Norway[38] 2005**	**Sweden[39] 1999**	**Finland[40] 1996**	**Denmark[41] 1999**
Landfill	65-70	18	23	80	12
Incineration	15	40	39	1-2	59
Composting				4-7	
Material recycling	15-20	40	29	11-15	29
Other		3	9		

The figures in the table derive from different years and show that Denmark for example incinerates a higher proportion of waste than the other Nordic countries. In Norway[38] household waste increased from 269 kg per citizen in 1996 to 407 kg per citizen in 2005. The quantity sorted for material recycling increased from 20 to 44%, and in 2005 a total of 70% was sorted for recycling or incinerated. It is estimated that most of the diapers used in Norway are delivered together with residual waste for incineration or dumping in landfills. Statistics for 1997 show that in Norway 4.2% of household waste consisted of diapers and sanitary pads. These are the most recent statistics available. Only a handful of local authorities in Norway collect diapers together with wet organic waste for composting. According to the British LCA study, 2-3% of household waste consists of diapers. SCA's Norwegian website states that approximately 5% of household waste consists of diapers.

4.6 Environmental gains

The preceding chapters describe the raw materials that may be contained in sanitary products and note the environmental problems associated with both the production of the products and the large quantities of waste generated. Although ecolabelling can have no influence of whether consumers and buyers choose disposable products or the ways in which the products are processed as waste, there is nevertheless major potential for improving the products by imposing requirements as to raw materials and production conditions. Although the Swan-labelling requirements could have been formulated in such a way that they facilitate a particular type of waste processing, this version of the document does not promote for example compostable diapers. The reason that the document does not impose requirements promoting a particular type of waste processing is the large proportion of diapers on the Nordic market that are incinerated. However, it would be a beneficial additional quality if the composting of sanitary products were facilitated.

The British LCA study concludes that in order to achieve improvements in disposable diapers the manufacturers of the diapers should focus on weight reductions and improvements in the production of materials. This coincides well with the requirements imposed hitherto by Nordic Ecolabelling as regards the Swan-labelling of sanitary products and also with the proposals contained in this consultative document. The requirements applicable to the Swan-labelling of hygiene products are described in further detail in Chapter 7.

5 Definition of the product group

5.1 Sanitary products eligible for Swan-labelling

The product group "Sanitary products" comprises disposable products such as breast pads, children's diapers, incontinence care products (panty liners, shaped diapers and diapers with tape strips), sanitary towels (towels and panty liners), tampons, cotton buds, cotton wool, toothpicks, bedding underlays, draw sheets, wash cloths and surgical gowns.

Relevant disposable products in addition to those specified above that may be viewed as sanitary products may be included in the product group upon request. Assistance in this is available from the Nordic Ecolabelling secretariats.

It should be noted that the product group includes only disposable products and that the only products included in the group are those composed of materials with respect to which requirements are imposed in this document. Requirement R2, percentage composition, specifies that at least 95% of the materials used in the product must be materials on which requirements are imposed. This means that other materials may be present in small quantities without fulfilling specific requirements. Other materials might for example include rubber (elastic), $CaCO_3$, wax for preventing leakages in seams etc.

Since the last version, the product group has been extended to include cotton buds, cotton wool, toothpicks, underlays and draw sheets, wash cloths and surgical gowns. However, some relevant products may have been overlooked and accordingly the

definition also opens the way for the inclusion of other disposable sanitary products subject to application to Nordic Ecolabelling. This means that Nordic Ecolabelling decides which products may be included. One reason for this is that it is important for an assessment to be conducted of whether the new products should for example satisfy other performance or quality requirements. It is important that the new products should consist of the materials on which requirements are imposed in the criteria, thus preventing excessive growth in the criteria set.

This extention of the product group reflects the recommendations made in the evaluation of the Swan-labelling of sanitary products conducted in 2005, which sought a broad definition to allow the criteria to encompass disposable products for personal hygiene where the primary materials in the product include paper pulp, cotton, viscose or plastic materials, i.e. materials on which requirements are imposed in the criteria document.

5.2 Sanitary products not eligible for a Swan Label

Wet wipes, paper handkerchiefs, wash cloths made of paper or textile materials, and mesh pants for use together with certain sanitary products are not eligible for Swan-labelling under the criteria for the Swan-labelling of sanitary products.

Products containing medications/medicine, disinfectant substances and the like are not eligible for ecolabelling.

Nordic Ecolabelling has developed ecolabelling criteria for over 60 different products and services, and even if a product appears to be eligible for ecolabelling under several criteria, Nordic Ecolabelling determines which criteria document the product will be encompassed by. Wet wipes (may be Swan-labelled under the cosmetics criteria), paper handkerchiefs or wash cloths made of paper (may be Swan-labelled under the soft tissue criteria), or multiple use wash cloths and mesh pants (may be ecolabelled under the Swan or Flower textile criteria) are not eligible for Swan-labelling under the criteria for sanitary products.

Disposable wash cloths made of materials on which requirements are imposed (e.g laminated products or products made of non-woven) can be ecolabelled as long as they will be out ruled from the criteria for ecolabelling of textiles or tissue paper. Products containing medications/medicine, disinfectant substances and the like can not be ecolabelled. Disposable wash cloths are not eligible to for ecolabelling under the criteria for sanitary products according to the consultative proposal.

5.3 The version number and period of validity of the criteria document

This background memo provides the background to and the stringency of the requirements imposed in the consultative document for “The Swan-labelling of Sanitary Products, Version 5, Consultative Draft”. The background memo remains valid for the same period of time as the criteria document. Swan-labelling criteria are normally valid for 3 – 5 years before the requirements are revised. During the revision process the requirements will be evaluated and the stringency of the requirements increased, if applicable. A new version of the criteria will be in force for at least one year before the existing criteria cease to apply. The Board of Nordic Ecolabelling

is Nordic Ecolabelling's highest decision-making body and has the final word on all criteria documents. The Board comprises the heads of the national boards/committees and the managers of the national secretariats in Denmark, Finland, Iceland, Norway and Sweden.

6 Application for a Swan Label for sanitary products

The applicant must submit documentation as specified below for each individual requirement in the criteria document. The application must be accompanied by an outline specifying the documentation attached for each individual requirement. All information submitted to Nordic Ecolabelling will be treated confidentially. This will also apply to the applicant's name and product names until such time as a licence is granted.

Documentation must be submitted only for the sanitary products encompassed by the application. Subcontractors may submit confidential documentation directly to the ecolabelling organisation, and all such information will be treated confidentially.

In order for a manufacturer or agent to be granted a Swan Label for a product, all requirements in the criteria document must be met.

7 The background to the stringency of the criteria

This chapter provides detailed descriptions of the individual requirements and the background to the requirements. The chapter is divided into the same subsections and requirements as the consultative draft of version 5 of the criteria for the Swan-labelling of sanitary products (June 2007).

A large part of the environmental impact associated with disposable sanitary products derives from the production of the raw materials used in the products. Accordingly, detailed requirements are imposed on the production of the ingoing raw materials. Some environmental impact is also associated with the processing of the products in waste form. Here, however, Nordic Ecolabelling has opted not to impose requirements in the consultative draft for how the consumers shall handle the products after use, amongst other reasons because numerous ways exist for processing sanitary products as waste and because Nordic Ecolabelling cannot impose requirements on the further processing of products as waste. Both health and environmental requirements apply to the constituent substances contained in sanitary products.

7.1 Product description

Requirements R1 and R2 - Description of the product and packaging with details of percentage composition
These requirements are imposed in order to ensure that an overview is provided of the product and the packaging for which the licence is sought. It will make it simpler to determine which requirements the raw materials must fulfil. The requirement also makes it clear that requirements are imposed with respect to the primary packaging on the product and that this includes both the packaging around the individual product in

a pack and the packaging on the pack as it is sold in the shop or directly to the customer.

In the case of a Swan-labelled sanitary product 100% of the constituent components must be disclosed, and 95% of the materials, components and constituent substances must fulfil requirements imposed in the criteria document. Thread present in quantities of less than 1% is exempted from the requirements because the quantities involved are so small and it may be made of cotton or polyester on which requirements are imposed, but where this may have been several stages further back in the production process and accordingly difficult to document satisfactorily.

7.2 Materials in the product and packaging

7.2.1 Chemical products

Requirement R3 - Chemical products, classification

No chemical products used in the production of sanitary products must be classified as harmful to health or the environment. This is a general requirement and applies to all chemical additives present in sanitary products, even where these products are subject to additional requirements in later chapters, for example adhesives, silicon and ink/dyestuffs. Odour control substances permitted in incontinence care products must also fulfil the requirement. The stringency of the requirement has been increased since the last version of the criteria for environmental and health reasons.

7.2.2 Fluff pulp

Fluff pulp production

Fluff pulp for sanitary products is specially produced for this purpose and is manufactured from wood fibre. To be used in sanitary products the fluff pulp must possess particular properties: both processing properties and absorption must be of a satisfactory quality. Fluff pulp must:

- be readily dispersible when dry
- not create dust in the threading machinery
- not require the use of excessive energy during defibring
- provide the end product with satisfactory absorption
- have a regulated and predictable tendency to create fibre bonds, everything from the affinity of dry paper to unretarded affinity
- arrive in the appropriate form for sanitary product production. Often this means that the pulp is in roll form rather than in ball form, which is customary in paper production.

As in the case of tissue paper, a low content of fine fractions, chippings and resin in the pulp is preferable. Pulp for fluff pulp is produced in such a way that each process stage is optimalised in order to produce the required product properties. This means that the drying of the pulp and the addition of chemicals is controlled very precisely. The pulp may be produced in a variety of different ways: using the CTMP (chemical thermomechanical pulp) method, or boiled using the sulphite or sulphate method. The fibre raw material is also selected carefully, long fibres offering a number of advantages. In Europe a handful of pulp mills specialise in the production of fluff

pulp, and these include sulphate mills. In Europe CTMP fluff pulp has declined over the last ten years. However, pulp is imported to Europe from other parts of the world, as are sanitary products containing for example CTMP pulp.

A fluff pulp can be finished completely on the drying machine, including any applicable chemical additives, or may be produced using a native pre-fluff pulp where chemicals are added at a later stage. In the former case fluff pulp production will occupy a whole pulp drying line at the mill. In the latter case there is scope for variation, but the disadvantage is that the addition of chemicals must take place while the pulp is wet, in other words the pulp will need to be dried once more before it is finished. The advantage is faster quality switching and the scope for re-centrifuging the pulp, allowing "dirty" pulp to be used. Some pulps that are insufficiently bleached thus contain bark traces and fibres containing dark particles.

One of the most important factors in fluff pulp production is the degree of debonding. In some fluff pulps no extra chemicals are added; in others debonding agents or softeners are added to reduce fibre-to-fibre bonding. Two types of agents for debonding are in use: aliphatic acid mixtures and agents containing strong cationic quaternary ammonium compounds as the active ingredient. The latter substances are classified as environmentally harmful, risk phrase R50 (Very toxic to aquatic organisms). However, in contact with anionic fibres this effect is negated. In other words, they can be interpreted as not being environmentally harmful when in contact with pulp.

Requirements R4 – R8 Requirements as to fluff pulp

The fluff pulp requirements in the last version of the criteria for the Swan-labelling of sanitary products referred to the requirements contained in the criteria for tissue paper. The tissue paper criteria have since been revised, and the requirements applicable to pulp production are now covered under the Basic Module and the Chemical Module[42]. These criteria are common to a number of different types of paper and encompass the requirements applicable to fibre raw materials, emissions, energy consumption and chemical consumption. Accordingly the requirements are somewhat stricter than those contained in version 4 of the criteria for sanitary products. For further information on the background to the requirements applicable to fluff pulp reference is made to the background memo to the requirements in the Basic Module and the Chemical Module[43].

As regards the requirements applicable to fluff pulp reference is made to Chapter 2 of the Basic Module and to the chemical requirements in the Chemical Module. In addition the level of requirements that must be fulfilled is specified, since no specific level is provided for in Chapter 2 of the Basic Module. The level of requirements applicable to paper production is specified in Chapter 1 as a value where for example emissions from both paper and pulp production are added together. In addition to the general requirements applicable to pulp there is a requirement that the pulp must not be produced using return fibre. Broke is not classified as return fibre and may be used. The use of optical brightness in fluff pulp for sanitary products is not permitted. It is assumed that other chemicals used for fluff pulp will be covered by the chemical module. Accordingly no specific requirements are imposed as to debonding chemicals, over and above the requirements contained in the chemical module. As is

also noted in Chapter 4.2, the basic and chemical modules emphasise requirements intended to result in a reduction of environmental impact, particularly in forestry operations and in the production of fluff pulp. In other words, that the requirements result in special account being taken of biodiversity in forestry operations, reduced spread of environmental toxins, reduced impact of emissions resulting in acidification, added nutrients to water and reduced emissions of climate gases.

The use of return fibre in sanitary products is not permitted because these products come into close contact with the human body over periods of several hours. The use of return fibre could result in the body coming into contact with harmful substances in the fibre that are not removed at the pulp mill.

7.2.3 Cotton

The cotton requirements have been imposed to safeguard environmental, health and working environment considerations. Conventional cotton cultivation uses pesticides, defoliants, fertiliser and requires the use of large quantities of water, all of which contribute to major disadvantages in terms of health and the environment[44]. In organic production the system of cultivation is designed with a view to maximising preventive measures to counter pests and weeds, and readily soluble mineral fertilisers and chemical/synthetic insecticides are not used. Moreover, organic production is based on a holistic view encompassing the ecological, economic and social aspects of production and this approach to cultivation views nature as a whole. In 1995 organic cotton was cultivated in 18 countries, and the total harvest was estimated to be approximately 13,000 tonnes – equivalent to approximately 0.1% of world-wide cotton production. In the 2004-05 seasons organic cotton was cultivated in 22 countries, of which Turkey accounted for 40%, India 25%, USA 7.7% and China 7.3%, It is estimated that these countries cultivate 79% of all organic cotton[45]. It has been estimated that in 2005-06 some 31,000 tonnes of organic cotton will be cultivated world wide. This means that the proportion of organic cotton will be 0.12%, given that the January edition of International Cotton Advisory Committee World Cotton Situation Review estimates world-wide cotton production to be 25 million tonnes in 2006. It is estimated that in reality the figure for organic cotton is higher since in many countries registering production as organic is costly[46].

Organic cotton cultivation does not permit the use of genetically modified organisms (GMO). Organisms of this type are widely used in conventional cotton cultivation. For example, Monsanto (producer of GMO) reports that 80% of the land on which cotton is cultivated in Australia now contains genetically modified cotton[47]. There is wide-spread discussion about whether the use of GMO in cotton production represents an improvement in environmental terms. It is argued that GMO use reduces the use of pesticides and increases harvests, although others argue that this is simply a short-term view. In recent years a reduction in the number of birds in GMO cultivating areas has been reported, amongst other reasons because of the powerful insecticides used and because genetically modified crops generate fewer surplus seeds for the birds to eat[48]. There have also been reports of cows in India dying after grazing on GMO cotton fields after harvesting and that the use of insecticides has not fallen[49].

<u>Requirements R9-R10 – Cotton</u>

The requirements applicable to cotton are that the cotton must not be bleached using chlorine gas and that it must be cultivated organically or cultivated in a transitionary phase to organic production. This is the same requirement as in the previous version of the criteria document, but the option of documenting non-pesticide cultivation only has now been removed. The quantity of organically cultivated cotton has not increased significantly since the last revision. However, Nordic Ecolabelling is of the view that this requirement remains important, for amongst other reasons because cotton is used in products that come into close contact with the body, for example tampons.

The string on tampons is exempted from the requirement. The string is often made of cotton and makes up approximately 4% of the total quantity of cotton in the product. In order to prevent the string from snapping during use, strict quality requirements apply to the string. Organic cotton has shorter fibres and accordingly it is difficult to achieve satisfactory strength.

New EU organic cultivation requirements have been circulated for consultation and amendment proposals have now been submitted to the committee for further review[50]. The new rules are due to be implemented before 2009.

7.2.4 Viscose

Viscose fibre is produced from cellulose fibre and is classified as regenerated fibre. Paper pulp, for example, is used with alpha cellulose that is more than 89% pure being preferable. In other words, most of the lignin and hemicelluloses from the wood fibre has been removed. After treatment and bleaching using NaOH (alkalisation) the pulp undergoes swelling and is treated with CS_2 to produce cellulose xantogenate. This coagulates in an acid bath containing H_2SO_4, $NaSO_4$ and $ZnSO_4$. After further maturation, filtration and degassing the viscose is spun. Because viscose is normally produced on the basis of pulp, there may be major COD emissions during production. Further production stages result in emissions of both sulphur and zink (Zn).

Requirements R11-R14 – Viscose

The requirements provide that cellulose pulp must not be bleached using chlorine gas. Although no longer used in Europe, chlorine gas is still in use elsewhere in the world. Chlorine gas is an efficient bleaching agent, but results in heavy emissions of chloro-organic compounds. Satisfactory alternatives for bleaching cellulose pulp are available. The requirement applicable to COD emissions applies both to the production of pulp and the further processing of the viscose. TOC may be measured instead of COD if the interrelationship between the two values in the production process is stated. Routine analyses of COD using the ampule method contains environmentally harmful mercury (Hg) and a number of companies now use TOC as a parameter. The requirements applicable to emissions of S, Zn and COD have all been increased in stringency since the last version of the criteria.

7.2.5 Polymers

The polymers that may be present in sanitary products are polyethylene (PE), polypropylene (PP), polyester (PET), polyacrylic acid-based super-absorbents (SAP),

elastane and biopolymers (such as bio-SAP and starch-based thermo-plastics). Other polymers have also been considered, but have not been included in this version of the criteria.

In earlier versions of the criteria organic solvents were prohibited when extruding polyester fibres. This requirement was removed when version 4.5 was made, as the method is not in common use today.

Requirements R15 – Polymers, chlorinated plastics
This requirement has not been changed since the last version of the criteria. This is a requirement that Nordic Ecolabelling imposes in many criteria documents for products in which plastic materials have a short useful life.

The main problem areas associated with PVC are dioxin emissions, including during PVC production, the use of additives and the processing of PVC as waste. Small quantities of highly toxic dioxins may be formed during PVC production. According to the PVC Council of Denmark, provided that the technology and safety at the production site are satisfactory, most – but not all – dioxin emissions will be captured. In Sweden, the environmental authorities report that PVC raw material production accounts for approximately 1% of the total quantity of dioxin formed in the country[51]. In less modern facilities dioxins may be released into humans and the environment during emissions from PVC production[52]. In order to withstand the temperature required during the production of a PVC product, the PVC must be stabilised. The stabilizers may be based on lead, metal alloys (such as barium-zink and calcium-zink), tin or cadmium. 70% of all tin compounds produced are used for stabilising PVC[53]. 70% of the stabilizers used in PVC also contain lead. Cadmium and zink are also still used as stabilizers in PVC[54]. The PVC industry in Northern Europe has phased out the use of lead in stabilizers and a plan has been formulated to phase out this use throughout Europe by 2015. The industry in Europe committed itself to discontinuing the production of stabilizers containing cadmium in 2001. However, PVC products imported from the rest of the world are not subject to the same European restrictions on the use of lead or cadmium[54]. 15,000 tonnes of organic tin compounds were used in stabilizers for PVC in 1998, equivalent to 9.3% of the total consumption of stabilizers in Europe[54].

Approximately 50% of the chlorine ions in incineration plants in Europe derive from PVC. The main problems associated with the incineration of PVC are emissions of dioxins and the formation of waste in connection with the neutralisation of the hydrochloric acid that is formed as a result. Waste incineration accounted for approximately 40% of total dioxin emissions in the European Union between 1993 and 1995. However, the introduction of modern treatment technology has resulted in significant reductions in emissions. The EU has limits on the permitted emissions of dioxins from incineration plants, although these threshold values are not universally observed. Depending on the technology used to treat flue gases between 0.5 and 2 kg of waste is created per kilo of PVC incinerated. Moreover, this waste may contain heavy metals, making recycling difficult. On the whole it can be said that the environmental impact associated with the production, use and disposal of PVC is gradually shrinking, inter alia as a result of new knowledge and technological development. Nevertheless, all the signs are that there are still major problems associated with PVC. Nor are the control measures conducted on PVC imported to the

EU and the Nordic countries from other parts of the world adequate. Accordingly, Swan-labelled sanitary products, which are disposable products, are therefore subject to a prohibition against the use of PVC in the products or their packaging.

Requirements R16 – Polymers, plasticizers

As in earlier versions, phthalates are prohibited. In addition, the use of other plasticizers such as chlorinated paraffin is prohibited. This because these are compounds that are harmful to the environment, and because it would represent an unnecessary burden on the environment to permit sanitary products with such additives. A better solution is to use a different type of plastic where no such plasticizers are necessary.

Plasticizers are used in PVC to give plastic the required properties. Phthalates are not chemically bound to the plastic and may leak out of the products. Phthalates have long been a focus of attention because of their suspected effects on health. DEHP (Di(2-ethylhexyl)phthalate, DBP(Dibutylphthalate) and BBP (Benzylbutyphthalate) are classified as toxic for reproduction (R60, R61 and R62). DINP (diisononylphthalate), DIDP (diisodecylphthalate), DNOP (dioctylphthalate) are not classified, but the possibility that these substances represent a risk cannot be ruled out. An EU Commission working group has concluded that both DIDP and DINP cause category II endocrine disruption[55]. The reason that these substances have not been given an official EU classification is that there is no classification for endocrine disruption (not to be confused with harm to reproduction). Animal experiments have also shown that in high concentrations (above the classification level) DINP and DIDP may cause harm to the unborn child, impair fertility and cause liver damage. The EU has adopted a directive prohibiting the use of the three most harmful phthalates (DEHP, DBP and BBP) in all toys intended for use by children aged up to 14 years. There are indications that three other phthalates (DINP, DIDP and DNOP) may be harmful for reproduction, and these are accordingly prohibited in toys designed for young children which are likely to be chewed and bitten by children. The new regulations apply from 16 January 2007. The new ban will apply if concentrations of the phthalates in the part(s) of the product that has (have) been plasticized exceeds 0.1 percent by weight[56].

Requirements R17 – Polymers, catalysts

Catalysts must not contain chlorinated organic compounds, organic tin compounds, phthalates or antimony. Organic tin compounds are used in for example the production of some types of polyurethane. It is not know if organic tin compounds are used in plastics for sanitary products, but it is not ruled out that it may be used in e.g. the production of elastan. Antimonytrioxyde is used as a catalyst in the production of thermoplastic polyester, primarily PET. Thermoplastic polyester generally contains antimony in concentrations of 150-350 ppm (mg/kg)[57]. Phthalates and chloro-organic compounds are more widely used as auxiliary substances in catalysts. All these substances have harmful effects on health and the environment and their use should therefore be minimised.

Requirements R18 – Polymers, raw materials

Sanitary products weighing less than 5 g are exempted from this requirement. In the last version of the criteria the exemption was specified for tampons. In practice, the requirement has proved difficult to fulfil, even in the case of other small products

such as small panty-liners. For this reason a weight limit has now been introduced for sanitary products instead.

There is a choice under this requirement of whether to fulfil requirement A or requirement B. Requirement A is that a minimum of 7% of the polymers used must derive from renewable raw material. The level of this requirement has been increased from 5 to 7% since the last version of the criteria. The requirement is justified on the grounds that from a resource perspective it is important to promote the production of polymers based on renewable raw materials. The development of for example super-absorbents based on renewable raw materials has not proceeded as quickly as expected, and accordingly no major tightening up of the requirement has been proposed.

A polymer will be viewed as renewable if it consists of more than 75% renewable raw materials. Cellulose and viscose do not count as polymers. If the proportion of renewable raw materials in the polymer is less than 75%, the applicable proportion must be included in the calculation of the proportion of polymers from renewable raw materials. Non-polymer fillers cannot be deducted from the weight of the polymer, but must be counted as a non-renewable part. In the last version of the criteria the proportion of polymer that had renewable raw materials could be included in the calculations, even if it exceeded 75%.

Requirement B imposes requirements on the contribution to Global Warming Potential, GWP, made in polymer production including the production of both monomers and polymerisation. The use of this parameter has increased relevance and is increasing, amongst other reasons because it specifies the contribution made by production and if applicable the product to climate change and is stated in the form of CO_2 equivalents. The contribution made by polymers based on renewable resources is not included in the calculation under this requirement, even though production of these materials does contribute to climate change. Nevertheless it is considered important to promote the use of renewable resources. Polymers from renewable raw materials such as polylactic acid and biopolyolefine from biopulp (e.g. waste with a wood content via synthesis gas) both have lower emissions of CO_2 during production than do conventional polyethylene[58].

Even though GWP is now a parameter that is widely used in for example LCA studies, very few manufacturers publish these values. LCA studies frequently use average values for for example production in Europe, information that industry associations will disclose only subject to special application. This means that different studies will reach the same result for the use of the same quantity of the product. The plastics industry is not as open about its emissions as for example the wood processing industry, which over the last 10-20 years has published a variety of emission figures.

For this requirement the draft consultative document has used values calculated on the basis of published LCA studies, see Table 5, which is also included in the appendix to the criteria document. Nordic Ecolabelling has not had access to more precise and factory-specific figures. In LCA studies the values are often stated by product, and accordingly it has been necessary to calculate backwards in order to determine values per kilo of polymer. There are uncertainties attaching to calculations of this nature and

it is therefore hoped that more accurate information will be forthcoming during the consultative period.

Table 5. Values for GWP100* for selected polymers for production of the polymer (production of monomers and polymers)

Polymer	**GWP kg CO_2 eq/kg polymer****
SAP	3.40
PE	2.90
PET	4.80
PP	3.90

* Contribution to global warming, GWP, is expressed using a time scale of 100 years and stated as kg CO_2 equivalents per kilo of polymer.

** The values in the table are based on "Life Cycle Assessment of Disposable and Reusable Nappies in the UK", 2005, ISBN: 1-84-432427-3, The Environment Agency, www.environment-agency.gov.uk. The values in the study are stated as GWP100 for children's diaper use for 2.5 years. In order to calculate GWP as CO_2 eq/kg polymer the figure is divided by the quantity of polymer used in the production of the total number of diapers used by one child. Because of uncertainty attaching to the figures and because the values in the diaper study are based on average figures from production in Europe, the values are increased by approximately 10%.

The appendix to the criteria document also shows an example of a calculation for two diapers, as detailed below:

Table 6. Calculated values for GWP100* for two diapers

	Diaper 1		**Diaper 2**	
	Weight, g	g * GWP	**Weight, g**	g * GWP
Total weight	**45.0**		**48.0**	
Weight SAP	**11.0**	37.4	**8.0**	27.2
Weight PE	**7.0**	20.3	**7.0**	20.3
Weight PP	**7.0**	27.3	**6.0**	23.4
Bio-polymers and other materials	**20.0**	0	**24.1**	0
Total		**85**		**70.9**
GWP kg CO_2 eq/kg		**1.88**		**1.48**

Diaper 2 meets the requirements, but diaper 1 does not.

The advantage of including a GWP requirement is that it allows combinations of materials to be tried until a sanitary product with a low CO_2 impact is arrived at. This can be achieved by replacing polymers with bio-polymers, by using other polymers with a lower CO_2 impact or by only choosing a manufacturer with low CO_2 impact.

7.2.5.1 Superabsorbents

Nowadays the term superabsorbent generally refers to sodium salts of polyakrylic acid. A number of different types are being developed, e.g. by modifying the chain or by adding different side groups to produce new properties. Bio-SAPs based on starch are also produced. In Denmark work is being done on the development of a product based on soya with an absorbent core. This will provide an alternative to the superabsorbents usually used in sanitary products. However, at present time little information is available on this.

Polyakrylic acid is produced by polymerising the monomer, akrylic acid - CH_2-$CH(CO_2Na)$-, into long chains which curve when dry. Sodium persulphate, $Na_2S_2O_8$, is used as a radical initiator. During polymerisation a co-polymer is also added, which has more functional units than the akrylic acid, as a result of which it is able to bond with more molecules and thereby contribute to a three-dimensional structure. Polymerisation takes place in a sodium hydroxyde solution[59]. The radical polymerisation is exothermic and usually takes place in suspension. The ensuing polymer is rubber-like and retains water. It is then partially neutralised and dried, and then ground up into suitable particle sizes. The polymer in the surface of the particles can also be cross-linked in separate stages to give the material specific absorption properties. According to the BASF website[60] greater surface cross-linking gives the gel formed as a result of absorption of fluid greater absorption against pressure.

(Tetraallylethoxy) ethane and 1,1,1-Trimethylolpropanetricrylate (TMPTA) are customarily used for cross-linking[60]. Other examples of monomers that can contribute to cross-linking are: glycerol propoxy triacrylate, triallylamine, divinyl benzene divinyltoluene, polyethylene glycol monoallyl ether, glyoxal, ethylene glycol, di- or polyglycidyl ether and ethylene diamine. Cross-linking of the surface involves the use of e.g. glycerine and this often takes place in a solution of ethylene carbonate ($C_3H_4O_3$)[61]. The manufacturers reveal very little about the cross-linkers they use and it seems that virtually anything that can react with carboxylic acid has been tried. Very small quantities are used and analysis is therefore difficult according to Fredric L. Buchholz, Research leader at Dow Chemicals, writing in an article in Chemistry in the spring of 2005[61].

Polymer additives[60] include surfactants which help the gel to break down into smaller units. They may also increase “wetting” of the surface in order to improve swelling speed. Antioxidants are added to retain the whiteness of the SAP and reduce aging. Thermal or redox initiators reduce residual monomer levels, which is important in sanitary products that come into contact with skin. Flow modifiers such as fumed silica can help the polymer powder to flow more smoothly during production and improve the permeability of hydrated SAP.

Extractives from SAP are low-molecular compounds that can be extracted from the polymer in the event of a fluid surplus. Residual monomers from SAP are also measured and these might for example be cross-linkers that were not taken up in the polymer network during polymerisation. The background memo to the last version of the criteria document for sanitary products, version 4, stated that “SAP has no allergic side effects. However, residual monomers from the SAP may have an allergic effect. The applicable requirement is accordingly a maximum of 400 ppm residual monomers in the SAP in question and a maximum 5% (w/w) water-soluble extracts”. A search on the Internet reveals that nowadays products can in theory be produced with less than 200 ppm residual monomers[62]. The major manufacturers have no information on residual monomer content or extractives on their websites.

The akrylic acid monomer is produced using propene (propylene) from refineries. Degussa[63] uses a two-stage process with gas phase oxidation of propene via acroleine (propenal, C_3H_4O). Acroleine is toxic in concentrations of over 2 ppm. According to the European BAT Report on large volume organic chemical industry[64], production

emissions are minimised by means of incineration of both waste water and gas emissions.

Acrylic acid (CAS No. 79-10-7) is a colourless and corrosive fluid. It is produced in nature by a number of marine algae types and in the stomach of sheep. Industrial production is used for the further production of monomers (e.g. amides, akrylonitrile, vinyl, styrene and butadiene) for polymers for use of the production of plastic materials, coatings, glue, elastomers, floor polish and paint[65]. It has also been used as a pesticide[66]. Akrylic acid breaks down in air and water and is not viewed as bioaccumulable, but is classified as R10, R20/21/22, R35, R50. According to a fact sheet issued by the US Environmental Protection Agency[67] animal studies have shown reduced birth weights where acrylic acid is present in drinking water, but no other effects on reproduction. The Health and Safety Commission in Australia applies a limit value for exposure of 2 ppm (eight hours on average). In Norway the equivalent administrative standard is 10 ppm.

Properties of SAP
The polymer is capable of absorbing 200 times its own weight of tapwater[59] and then forms a gel. Absorption is diminished if the water contains salts and minerals and the swelling capacity is 20-40 ml urine per gram of polymer[69]. By comparison, fluff pulp is capable on average of absorbing approximately 12-14 g water per gram of dry fibre. The absorption of blood is slower, amongst other reasons because flows more slowly and contains lipids[61]. The polymer is known as a polyelectrolyte because it includes an electrolyte group in each unit which dissosiates in aqueous solutions, making the polymers charged. The swelling is based on osmotic pressure and the polymer functions as a semi-permeable membrane. According to Wikipedia[68], other salts of the polymer include potassium, lithium or ammonium salts.

Absorption under pressure is important from the perspective of leakages from sanitary products and will depend on the degree of cross-linking and stiffness of the polymer. In the core of a diaper there are capilliaries between the fibres in the fluff pulp and the polymer particles and these determine how the fluid is absorbed, distributed and retained in the diaper. This is affected by factors such as the temperature, distribution of materials and the degree of cross-linking of the polymer. EDANA, an international organisation for non-woven and related industry (including SAP) has developed a number of recommended tests (ERT) for polyakrylate superabsorbents such as: Residual monomers, Particle size distribution, Moisture content, Free swell capacity, Centrifuge retention capacity, Absorption under pressure, Flowrate, Density, Extractables, Respirable particles and Dust"[69].

Polyakrylic acid is not readily degradable biologically.

The market
According to EDANA worldwide production capacity in 2005 for polyakrylic acid totalled 1.5 million tons and approximately 90% of this is used in sanitary products. Other uses include cables, packaging foodstuffs, as an additive in cement, sealants for buildings, gardening and agriculture (as an inert growth medium in fertilizers), as instant snow in the film industry. It can also be used for fire control purposes[59,68,69.] The main manufacturers are Degussa, BASF, Dow, Nippon Shokubai and San-Dia Polymers.

Other factors
As was also noted in the last background memo, it appears that development work is under way on products capable of absorbing odour. According to a BASF patent, odour controlling substances may be "a cyclodextrin compound, an amphoteric surfactant, a water-insoluble phosphate, triclosan, and mixtures thereof"[70]. Because of reports of toxic shock syndrome resulting from the use of SAP in tampons this is not recommended by any manufacturers at present.

Biobased superabsorbents
Lysorb® is a bio-SAP produced by Lysac Technologies Inc. of Canada. It consists of renewable biological raw materials, is biodegradable and is not viewed as allergenic. According to the manufacturer the product is "hypoallergenic", which is a designation used for something that does not normally cause allergies, although this expression is not medically defined. Lysac manufactures the product using natural or modified starch from corn products such as maize and wheets as well as from guar gum. The material biodegrades by more than 90% during the course of 28 days and has no residual monomers.

Until now Bio-SAP particles have been bigger than SAP particles based on polyakrylic acid and has been mixed with polyakrylic acid SAP. In 2007 products that can be used without the need to mix in other products, stand alone products, are due to be launched.

Requirements R19-20 – Superabsorbents
The maximum values in the requirements have not been changed since the last version of the criteria and are a maximum of 400 ppm residual monomers and a maximum of 5% (w/w) water-soluble extracts in the SAP used. According to the EU's risk assessment[71] of akrylic acid exposure to the monomer may occur when SAP is used in sanitary products, although this exposure is expected to be low. Nevertheless, the maximum requirement of 400 ppm remains in place, and the requirement has now been specified in that only monomers that are classified as harmful to health or the environment are restricted. This reflects the standard formulation of chemical requirements in Nordic Ecolabelling's documents.

7.2.6 Non-woven

Requirements R21 – R22 – Non-woven
As described in Chapter 4-2, non-woven may be produced from a variety of materials. The non-woven requirements refer to the material requirements applicable to the materials used and to the chemical requirement if chemicals are used during production of the non-woven material.

7.2.7 Wood

The requirements as to wood apply to cotton buds and toothpicks made of wood. The requirement is probably not applicable to other sanitary products.

Requirements R23 – Wood - Forestry
The requirement is formulated in the same way as the forestry requirements in the criteria for Swan-labelled products that consist primarily of wood. The requirement is made up of a general requirement according to which the wood used must be taken from sustainable forestry operations and not from areas where social and biological values worthy of protection are under threat. Moreover at least 70% of the wood must be taken from certified sustainable forestry operations. Nordic Ecolabelling has a forestry group which assesses applicable forestry standards. This is described in further detail in an appendix to the criteria document.

7.3 Other materials and additives

All materials and additives in this chapter used in the production of sanitary products are also subject to the general requirement applicable to constituent substances in sanitary products, R3, Chemical Products, classification.

Requirement R24 – Cotton buds and toothpicks, material used in stick
The requirement specifies that cotton buds and toothpicks must not be made of plastic and that as well as being made of wood, cotton buds may also be made of board. If board is used, the material must not be bleached using chlorine gas. The products must not be made of plastic because at present the type of stiff polymer used in products of this nature is based on fossil raw materials.

Requirements R25 – R26 – Application of silicon
The first requirement, R25, specifies that organic solvents must not be used. There has been some criticism of this requirement because, it is argued, this is a process that is no longer in use. However, it is not entirely clear whether this applies to the world as a whole or solely to production in the Nordic countries and Europe. The requirement has therefore been retained. The next requirements is new and specifies that the use of octamethylcyclotetrasiloxane (CAS 556-67-2) is prohibited.

Siloxanes are used in a number of functions and may also be used in foam inhibitors, fuel additives, car polish and cleaning detergents. According to a recent Nordic study the present level of occurrence of siloxanes does not represent an environmental hazard, although some concentration is occurring because of their low degradability. Concentrations have been discovered near areas in which siloxanes are used industrially and in population centres. Siloxanes are volatile and accumulate readily in sewage sludge.

Sanitary products often features a silicon strip, normally on paper, but not always. This serves either as protection for a strip of velcro or as protection for a self-adhesive strip of glue. In the first of these instances the silicon-treated surface (the paper) stays on the diaper. The silicon surface of the diaper does not come into direct contact with the child's skin. A typical diaper (for a one-year old child) contains approximately 2 mg of silicon. In the second case the silicon barrier is removed (normally a strip of paper) in its entirety from the sanitary towel or pad in order to expose a self-adhesive strip. Typically the base paper will contain 1 g/m^2 of silicon.

The production of silicone-coated paper in the Nordic countries does not involve the use of solvent-based application, instead heat is used for curing. Solvent-based silicon

application usually occurs where the substrate is plastic. The requirement proscribing solvent-based silicon production is justified on health and safety grounds. Solvent-free silicon application is possible either using silicon emulsion in a water solution or entirely without the aid of solvents (solventless). In both cases the silicon is hardened using heat. Some catalysts occur, usually Pt-based.

The various siloxanes used include octamethylcyclotetrasiloxane (CAS 556-67-2), also referred to as D4 and classified as "May cause long-term adverse effects in the aquatic environment" (R53) and "Risk of impaired fertility" (R62). Even though D4 does not occur in European or Nordic sanitary products, there are grounds for prohibiting its use in ecolabelled sanitary products. Sanitary products or their siliconised components may be imported from countries in which the use of D4 is permitted.

Requirement R27 – Adhesives

The adhesives requirement has been extended from the proscription of phthalates to also include colophony. The background to the proscription of phthalates has already been described in the requirement applicable to plasticizers used in polymers, see R16 – Plasticizers. Colophony is prohibited because it may cause contact allergies. Colophony is drained from pine trees in the form of resin and is extracted using terpentine. The mixture contains a number of allergens.

Requirement R28 – Perfume and flavour additives

Perfume and other fragrance substances in the form of for example essential oils, plant oils and plant extracts must not occur in sanitary products. Perfume, essential oils and plant oils and plant extracts frequently contain several allergenic or carcinogenic substances. In order to avoid unnecessary effects on health caused by substances of this type the use of perfume and fragrance substances is completely proscribed. Moreover, perfume and fragrance substances serve no function in sanitary products (except in the case of incontinence care products) and are regarded as unnecessary. Sanitary pads and panty-liners with fragrance are available on the market. The requirements applicable to perfume have been extended in version 5.

With the inclusion of toothpicks in the product group, flavour additives have been proscribed. Flavour such as peppermint may be added to toothpicks. The reason for the proscription is the same as in the case of perfume.

Requirement R29 – Lotion and skin care preparations

Sanitary products must not contain lotion or skin care and/or moisturising preparations. A small change has been made to this requirement since criteria version 4, which specified that "the product must not contain lotion/moisturiser". To achieve a lotion effect, i.e. a moisturising effect from the surface of a sanitary product, a pre-mixed lotion is sometimes applied to the sanitary product, and in other cases ingredients with a moisturising and skin care effect may be added to the product individually. Moisturising and skin care preparations include Aloe Vera, Chamomilla Recutita, Glyceryl Stearate and Protolatum (Vaseline). Lotion preparations may contain allergenic and carcinogenic substances. Since lotion and skin care and moisturising preparations are not essential to the function of sanitary products, they are excluded for health reasons. Sanitary towels and panty-liners with a lotion effect are available on the market.

Requirement R30 – Odour control substances
As in the last version odour control substances are prohibited, except in incontinence care products. The criteria document emphasises that any odour control substances used must satisfy R3 Chemical products, classification.

Requirement R31 - Medicaments
The criteria for sanitary products have been extended to take in a number of new product types. For the avoidance of doubt about whether a product to which medicine or disinfectant substances have been added is effective and lives up to the health-related requirements applicable to the product in question, Nordic Ecolabelling has decided to proscribe medicaments in ecolabelled sanitary products. Medicaments are chemical substances designed to prevent, alleviate or cure illness, sickness symptoms and pain or to alter bodily functions (cf. the definition of Article 2 of the Cosmetics Directive). Such substances may also include chemical substances e.g. silver compounds (wound-healing) and trilosan (antibacterial and disinfectant substances).

An exception has been made in the case of lactic acid bacteria in tampons. These bacteria are added to a type of tampon in order to maintain the pH balance in the vagina. Lactic acid bacteria occur naturally in the body and are therefore not defined as a medicine.

Requirements R32 – R33 – Nanomaterials and flame retardants
The proscriptions of nanomaterials and flame retardants are both new requirements that have been included on the basis of the precautionary principle. Nanomaterials/nanoparticles are added to many new products in order to for example give the product an antibacterial effect or surface. These are properties that are unnecessary in normal sanitary products, and accordingly nanomaterials are proscribed. Little is known about the effects on health and the environment of nanomaterials/nanoparticles, amongst other reasons because no tests have yet been developed suitable for measuring the effects of these materials/particles. According to the information available nonomaterials/nanoparticles are not used in sanitary products at present.

Nor as far as Nordic Ecolabelling is aware are flame retardants used in sanitary products. However, Nordic Ecolabelling has registered that flame retardants are applied to products if they are flammable and are to be stored in a way where the consequences of a fire would be disastrous.

7.4 Colours for printing and dyeing

Requirements R34 – R35 – Colours for printing and dyeing
The proscription against dyeing sanitary products is a new requirement. Exceptions may be granted from this requirement in the case of specialist products for use in hospitals and nursing homes if special reasons exist for colouring the products, for example to enable staff to distinguish between various sizes or the like.

Black panty-liners have been available on the market, and because a number of colours/dyestuffs are harmful to health and the environment, the unnecessary dyeing

of the products should be prohibited. If the products are to be dyed, they must satisfy the requirements contained in the chemical module ("The Swan-labelling of paper products – Chemical module, version 1 or later").

Print is found on certain hygiene products, e.g. on diapers, the reverse of the release paper on the bottom of panty-liners and on incontinence care products etc. Generally, flexographic printing is used. The requirement is therefore imposed that flexographic printing is the only printing method that may be used on sanitary products. This requirement does not apply to print on product packaging. The inks used in flexographic printing are also subject to the requirements contained in the chemical module. A more in-depth description of the background to the requirement imposed in the chemical module can be found in the document "Background memo. Modules for Swan-labelled paper products – The Module system – Background for the basic module and the chemical module, February 2003".

Requirements R36 – R37 - Packaging
No changes have been made to this requirement since the last version of the criteria. In the case of plastic packaging, PVC or other halogen-based polymers are proscribed, and the plastic must be labelled to allow the types of plastic materials used to be identified. Sanitary products are frequently packaged in group packaging and some product types such as incontinence care products, panty-liners and tampons may be individually packaged to allow them to be carried in for example a handbag. Some sanitary towels may be packaged in plastic packaging that also functions as "release" paper. Because individual packaging may be important for reasons of hygiene, no requirements are imposed with regard to the permitted quantity of packaging on the individual product.

Requirement R38 - Waste
No changes have been made to the requirements applicable to waste generated during the production of sanitary products. Waste must be sorted at source and the maximum permitted quantity of waste is 5% (w/w) if waste products are not recovered and recycled.

In the case of waste generated in the production of tampons a maximum of 10% (w/w) is permitted. Generally more waste is generated during the production of tampons than other sanitary products as a result of which the requirement is not as high as in the case of diapers/sanitary towels.

7.5 Requirements as to products

Requirement R39 - Tampons
As in the previous version, restrictions apply to the quantity of aerobic micro-organisms per gram of product. This requirement has been imposed for reasons of hygiene.

Requirement R40 – Information text
Some changes have been made to the requirements applicable to the information text since the last version of the criteria. The declaration of all materials in the product and their weight (in g) is no longer required. There was some uncertainty about how the

requirement should be interpreted and about the degree of detail that the declared information should contain. Whether or not the materials contained in a product were declared varies from product type to product type and more information will generally be provided on products such as tampons than in the case of diapers or sanitary towels/panty-liners.

A new requirement has been introduced according to which consumers must be urged not to discard cotton buds in the toilet. Cotton buds get caught in the mechanical filters of treatment plants creating problems.

The other requirements applicable to the information text, such as the disclosure of information on the absorption ability of the relevant products, the specification of the size of the product and in the case of tampons the amount of fibre that may be released during use are unchanged. This is information that is of importance to consumers because they wish to use products that perform satisfactorily the first time they are used. The parameters that are of interest to the consumer are the purpose of the product, if applicable the age or size of the consumer (this applies in particular to diapers for use by children) and the time at which the product is to be used. One good example of the latter is sanitary towels for for example day time or night time use.

Requirement R41 - Function

It is in the interest of both licence holders and ecolabelling that Swan-labelled sanitary products should have satisfactory performance characteristics. The function requirement states that: *"The effectiveness/quality of the product shall be satisfactory and on a par with equivalent products available on the market. In the case of products where an acknowledged test is available this test must be used. Tests might include laboratory test, the manufacturer/applicant internal quality testing, consumer testing or comparable test on an equivalent product. In the case of diapers, sanitary products (sanitary towels and panty-liners), incontinence care products and breast pads, the performance test must as a minimum cover absorption and dryness on the exterior side. In the case of tampons the performance test must as a minimum include absorption ability. If a consumer test is performed, a minimum of 80% must be satisfied with the product out of the minimum of 10 users."*

Standard performance tests do not exist for most types of sanitary products. One exception is incontinence care products, where a standard does exist. Manufacturers may accordingly use their own modified tests for children's diapers, sanitary towels, breast pads and other sanitary products, in other words there is a certain degree of freedom in relation to documentation. Different tests may be used provided that the test used provides answers to relevant parameters, and comparisons must be made with equivalent products available on the market. The responsibility for finding equivalent products is left to the licence applicant and considerable variations and degrees of detail exist for sanitary products.

Many manufacturers of sanitary products and producers of the raw materials used in sanitary products have expressed the wish that Nordic Ecolabelling should impose requirements as to the performance of specific tests and the measurement of various parameters such as absorption ability under pressure, swelling capacity etc. However, variations exist in the way the products are built up and the way the products function for the individual consumer. For example some parents prefer a particular brand of

diaper, whereas others are of the view that a different brand suits their child better A range of tests has been performed by various consumer organisations/consumer magazines, and as long as these tests show that the products function "well enough", Nordic Ecolabelling does not wish to impose specific requirements in relation to the tests conducted. For example some consumers may prefer the product to have a different fit, some prefer the thinnest products, others in turn may prefer a slightly thicker product that allows more air to circulate and does not feel so enclosed.

The background memo to the last version of the criteria stated that:
"Tests conducted by the National Consumer Agency (NCA) in Denmark have shown that there are no major differences between the technical properties of the different types of diaper that exist. They all meet the requirements applicable to absorption ability and surface dryness. In an in-depth interview the NCA stated that it is not necessary for a diaper to absorb more than the diapers that are available on the market at present. In fact some diapers have an unnecessarily high absorption capacity. What it is important to look at is whether the fit is sufficiently good. Here it is an advantage for the diaper to be thin to allow itself to mould itself more closely to the body.

Test conducted by the NCA on sanitary towels show that the absorbative capacity of most is satisfactory. Similarly most absorb sufficiently quickly for them to feel dry. However, there are differences in the amount that women bleed during a menstrual cycle (from 40 – 80 ml) and accordingly it is difficult to seg a specific figure for when absorption can be considered to be sufficient.

Both tests are based on SS 87 22 02, but have been adapted by the NCA.

Furthermore, tests on female sanitary products have also been conducted in Finland and Sweden. These tests too revealed little difference between the performances of the products. In Finland tests were conducted on 11 different sanitary towels produced by three manufacturers. The absorption capacity and surface dryness of all the sanitary towels was "very good" or "good". In Sweden tests were conducted on 9 sanitary towels and 4 tampons. The test revealed that the differences in price were significantly greater than in quality.

No changes have been made to the product testing requirement. However, investigations should be conducted into whether the required tests are sufficient or whether simpler means might exist for testing performance. The performance of the products is an important parameter which cannot be ignored."

Since the background memo for the last version of the criteria was drafted, a number of tests have been performed on sanitary products. The most recent test on tampons was conducted in Økotest No. 4/2007. In the report "Diapers and the environment" from January 2004, the results from different tests of diapers from 1993 till 2003 are given[2].

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