

# Ecolabelling of printed matter - part I

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# Preface

This project has been conducted with the support of the Danish Environmental Protection Agency. It started in April 2003 and was concluded in April 2004. The project was run by the Graphics Association of Denmark, GA – the employers' federation for the Danish printing industry. The project manager was Ninna Johnsen, GA.

The project was carried out with the help of the Institute of Product Development, IPU, and the Department of Engineering and Management, IPL, Technical University of Denmark.

The purpose of the project was to analyse the Swan label criteria for printed matter from a life cycle analysis perspective and produce well founded suggestions for changes to the criteria, including recommendations concerning the synergy effect of combining environmental management and environmental product declarations. The project was also related to the development of criteria for the EU environmental label, the Flower.

The target group for the results of the project includes institutions involved in developing and defining criteria for the EU Flower label for printed matter, and Nordic institutions involved in the development, revision, approval and monitoring of the Swan label for printed matter.

The project has been delivered in two parts, the first part is this main report itself, "Ecolabelling of printed matter - part I", whereas the second part is a working report, "Ecolabelling of printed matter - part II; Life Cycle Assessment of model sheet fed offset printed matter", Working report no. 24, 2006".

The members of the steering committee were:

- Søren Mørch Andersen, Danish Environmental Protection Agency
- Jesper Gruvmark, Environmental labelling secretariat
- Kerstin Sahlen, SIS Ecolabelling AB
- Kim Hansen, Phønix-Trykkeriet as
- Per K. Hansen, Stibo Graphic A/S
- Flemming Skovlund, Schultz Grafisk A/S
- Steinar Webjornsen, Media Association, Norway
- Helene Markussen, Association of Danish Daily Newspapers
- Henrik Fred Larsen, IPU, IPL, Technical University of Denmark
- Christian Poll, IPU
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- Anette Møller, GA
- Ninna Johnsen, GA

June, 2006



# Summary article

New perspective on environmental impact of printed matter

## *Introduction*

The results of a new life cycle analysis have changed the scientific basis of the criteria, which have been used up until now for the Swan ecolabel. Including chemicals to a much greater extent than in previous studies, the LCA now focuses much more on production and the use of chemicals in determining the overall environmental impact. The environmental criteria behind the Swan label for printed matter have previously been and are to some extent still currently linked to a number of earlier studies, which have all identified paper as by far the most significant environmentally damaging factor from printed matter. These studies only looked at the use of chemicals to a limited degree.

## *Background and purpose*

Printed matter has been the most successful area for the Swan label. Currently, around 130 licences have been awarded for the product group, which outstrips any other Swan labelled types of products. The criteria document for printed matter is comprehensive, and the terms are demanding for those who wish to maintain their licences. Within the document there is an implicit balance of which phases and processes are of greater or lesser importance from an environmental perspective, and this is also based on the art of the possible in regard to current technologies and what the market can accept.

In recent years there have been lively discussions about revisions to the criteria document, as there are different views as to what weight should be placed on the many requirements the document contains, and how they should be formulated. The project was conducted largely in an attempt to illuminate these discussions. Using a complete life cycle analysis and the latest data, along with the EDIP method, meant that it was possible to update the data to form a better impression of environmental impacts generated by producing printed matter and so to make a new assessment as to whether the criteria for the Swan label actually cover all the knowledge available.

Another main reason for conducting the project was that the EU has begun the process of drawing up the initial criteria document for the Flower label in regard to printed matter. Through this project, Denmark can make a significant contribution to the scientific basis of the Flower label as well as trying to harmonise the Flower and Swan labels.

What does the life cycle analysis show?

The results of the life cycle analysis provide a picture of the varying importance of the environmental impacts generated by producing printed matter.

This is the only method, which makes it possible to accord the right value to all the aspects of a product throughout its lifetime, from the extraction of raw materials through the production process, use and disposal. The EDIP method is an internationally recognised procedure for conducting a life cycle analysis, and was developed in Denmark in the 1990s, since when it has been used in a large number of both Danish and international projects.

## Principal conclusions

The key conclusions of the project are summarised below:

- Including chemical data in the LCA to a greater extent than in previous studies gives a different environmental profile for printed matter than has been the case until now.
- The analyses thus could suggest that changes should be made to the existing Swan label criteria document. This applies both to the weighting of requirements for raw materials and processes in relation both to the overall production process and for the individual steps within this process.
- The results of the LCA study provide a basis for drawing up a criteria document for the EU Flower label for printed matter (sheet fed offset).
- The results of the LCA study make it possible for printing companies to work in a targeted manner with their suppliers regarding environmental aspects on a more solid scientific basis than previously, as those companies which work with standardised environmental management systems now have an improved tool for identifying their most significant environmental impacts.

A large proportion of the companies in the graphics sector have environmental management systems in place and ecolabelling licences, and allocate a lot of resources to environmental work. In the light of this data, it is even more important, both for individual companies and society as a whole that these resources are used as optimally as possible by controlling the key parameters. In the future, as a result of this project, printing companies will be able to organise their environmental work and use their resources with much more benefit for the environment than before, and also individual companies will be able to construct a more credible basis for their marketing activities.

The project has resulted in two reports, one about the LCA study itself, and another, which lays out the conclusions from the LCA, study and examines the synergy effects between environmental management systems and environmental labelling.

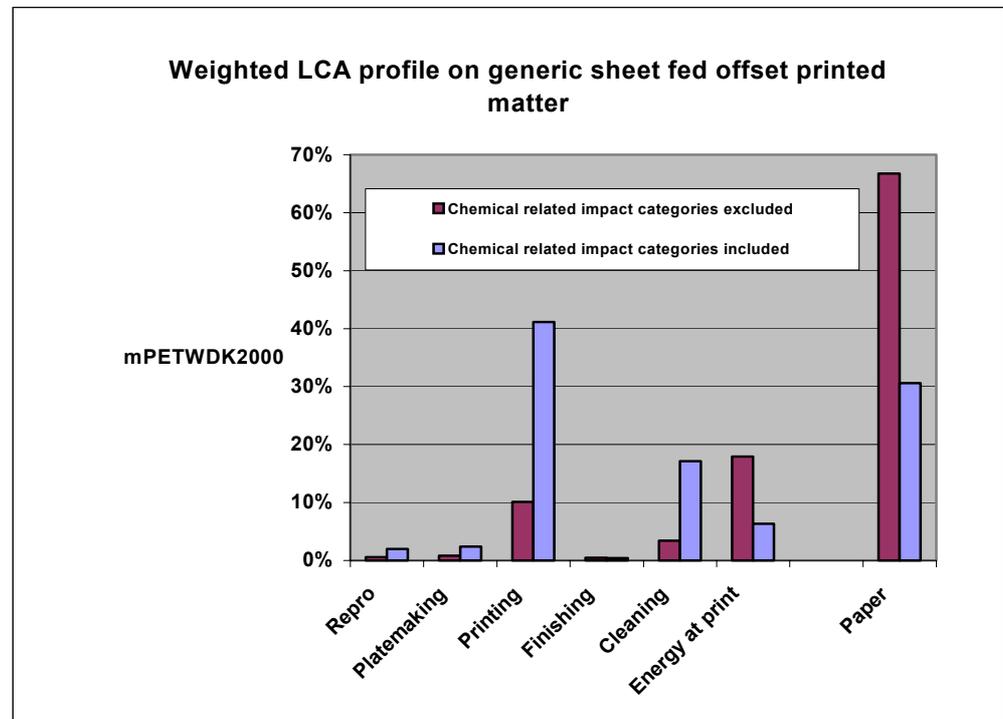
## Project results

### *Life cycle analysis of the production of printed matter*

The aim of this study has been to identify the spread of environmental impacts throughout the entire life cycle of printed matter produced using the sheet-offset method. The functional unit taken was one tonne of printed matter.

The contribution to the environmental impact is presented for each different phase of production and using the impact categories defined by the EDIP

method. Paper has been dealt with separately, because previous LCAs have shown that it is a dominant environmental factor in printed matter. However, this project has shown that if the chemicals are included on a more comprehensive basis, that printing contributes significantly more (41%) than paper (31%), see figure below. In terms of resource usage, paper is still dominant, at 48%, not least because of the energy intensive method of paper production, see report II, figure 16.



The results appear to cover the average production of printed matter both in the Nordic countries and other European countries where sheet fed offset is used. In addition to the reference scenario, seven other scenarios and various sensitivity analyses were developed in the project, with variations from the reference scenario regarding consumption, emissions, methods etc: Data used in the scenarios is, among others, based on investigations in Nordic printing companies, referring to the table 2 in the report part II. This has given rise to the following conclusions for the overall environmental impact incl. paper:

- Applying biological treatment of wastewater could reduce the environmental impact by approximately 26%.
- Reducing ink use from 26.5 kg to 1.8 kg could reduce the overall environmental impact by approximately 56%. (consumptions figures from a published Swedish survey)
- Replacing the biocide benzalkonium chloride with Kathon (the active agents are two isothiazolinone) mainly from process where water is recycled could reduce the overall environmental impact by approximately 69% (excluding wastewater treatment). The scenario is a worst case, and reference could be found in the report part II, figure 28)

- The environmental impact can be reduced with approximately 16% by using exclusively recycled paper instead of exclusively virgin paper.
- The environmental impact can be reduced with approximately 26% by using entirely volatile aliphatic cleaning agents instead of entirely vegetable-based cleaning agents.

The LCA study not only provides a picture of the environmental impacts from the various phases and processes, but also, through the sensitivity analysis supports the robustness of the conclusions. One example is the surprising finding that there is only a 16% difference between using recycled or virgin paper, whereas it is clear that using the most environmentally friendly biocide makes a difference of 69%.

It should be mentioned here, however, that the LCA study, as is typical with life cycle assessments, does not include the working environment and so nor does it include any occupational health and safety consequences of, for example, substituting chemicals. These conditions therefore need to be assessed separately within the Working place assessments routines.

It was not possible to deal with some issues fully, especially because of a shortage of data. Although it is considered that including these conditions would probably not affect the overall result, some significance cannot be completely excluded.

- Other upstream chemical emissions, such as those not included in producing ink.
- Degassing of methane from paper disposed of as land fill in the cases where paper is not recycled or incinerated. The volume of methane, which ends up in the atmosphere, is not known.
- Final disposal of chemical or other waste.

Review and establishment of environmental label criteria and suppliers' environmental statements

In terms of the criteria for printed matter under the Swan label and the LCA studies up till then, the new study shows that the distribution between the environmental impacts from printed matter produced using the sheet offset method is different than previously thought.

### *Structure*

An analysis of the criteria document shows that the current form is inconsistent in the requirements placed on the same appropriate substances throughout the processes. It is therefore proposed that the document be structured in a more rigorous way, where criteria are set in general for various substances and groups of substances and can then be adjusted (tightened or relaxed) for specific processes and materials.

### *Lack of knowledge*

A lack of knowledge has been identified in the following areas:

- Should the focus be on the choice of inks, or on cleaner technology and emission control instead?

- How can energy be saved in the life cycle of printed matter?
- Is it possible to establish criteria for the use of transport?
- Is weight the real functional unit or should a different parameter, such as surface area, be used?

### *Establishing databases*

For the environmental labels it would be an advantage to construct simple LCA databases, for example, for each product group or printing technique. Over time such data would make it easier to assess the consequences of such things as substitution and reduction of emissions. A common LCA data foundation would also make integration with other product-oriented schemes, such as environmental product declarations, easier.

### *Existing environmental product declarations*

Paper Profile is an environmental product declaration, which the Nordic paper industry has developed. This scheme includes the most significant relevant emissions and requirements for energy accounting, but from an LCA perspective it can be said that energy produced internally from excess wood is not taken into account, and emissions of chemicals only include AOX. It can also be seen that the declaration scheme consists of an ISO 14020 type III (third party assessment), but as it has not been possible to fully verify it, it can be considered that it should rather be treated as a type II self-declaration. An integrated scheme on the same technical LCA basis could be used as type II, III or I scheme would be a great benefit.

### *Chemicals upstream*

It can often be difficult to obtain data for chemicals used “upstream” in production. The reason is often because of confidentiality regarding production, but also because most suppliers to the graphics sector in Denmark are from abroad and have a different tradition for and perception of what environmental information should be given. In this study, emission data for production of pigments has been estimated with the help of a new method of estimating upstream chemical emissions developed by DTU. This has shown to have a concrete significance (17%) for the results of the life cycle study.

### *Supply-chain collaboration and synergy effects of incorporating environmental labels into environmental management systems*

The last part of the project examines experience from Danish graphics companies' work with environmental management and the Swan label. The experience is taken from over 50 graphics companies, which have certified environmental management systems, and most of them also have a Swan licence.

The results are described systematically by firstly describing the experience of environmental management and environmental labelling, and then a number of combined effects which are typically achieved by incorporating the Swan label criteria into environmental management work and vice versa. Finally, a number of proposals are made for product-orientation of environmental management systems.

The examples of the synergy effects generated by environmental management in combination with environmental labelling selected are:

- Environmental strategy
- Environmental conditions, significant impacts and areas of initiative
- Evaluation of raw materials - waste
- Evaluating the production equipment
- Consumption of raw materials
- Advising customers
- Audit and monitoring

Despite a certain divergence between significant environmental conditions pointed out in environmental management systems in general and the significant environmental conditions contained in the Swan label criteria document, it can be said that an important synergy can be achieved to the benefit of the environment if the criteria document is used as the basis for the environmental management system in the areas mentioned above. It is considered that carrying out this LCA study will further strengthen this.

Throughout the course of the project the results have been incorporated in the Swedish Standards Institute's work for the European Commission with the aim of producing criteria for a European environmental label for printed matter. In general, the use of environmental management systems in graphics companies in Europe has spread to a certain degree, and it can be stated that the criteria document for the environmental Flower label, based on experience gathered from Denmark, would be able to provide a supportive and positive influence on the environment in terms of graphics production in Europe. This work would allow Denmark to contribute to a positive development on markets much larger than the Nordic one.

*Other sources*

[www.miljonet.org](http://www.miljonet.org)  
[www.ecolabel.dk](http://www.ecolabel.dk)  
[www.paperprofile.com](http://www.paperprofile.com)  
[www.lca-center.dk](http://www.lca-center.dk)  
[www.ga.dk](http://www.ga.dk)

# Sammenfattende artikel

Nyt syn på miljøbelastningen fra tryksager

## *Manchet*

Resultaterne fra et nyt livscyklusstudie ændrer på den viden, de eksisterende kriterier for Svanemærkning af tryksager hidtil har lænet sig op ad. Ved at inddrage kemikalier i LCA studiet i langt højere grad end i tidligere studier, rettes der nu i højere grad fokus mod produktionen og mod anvendelsen af kemikalier, når den samlede miljøbelastning skal gøres op. Miljømærkekriterierne under Svanen for tryksager har tidligere og i deres nuværende form i nogen grad knyttet sig til en række ældre studier, der alle har peget på papir som den altoverskyggende miljøbelastende faktor ved tryksager. Disse studier har kun i meget begrænset omfang indregnet kemikalier.

## Baggrund og formål

Miljømærket Svanens største succes er tryksagerne. Der findes i dag ca. 130 licenser for denne produktgruppe, hvilket langt overgår alle andre produktgrupper under Svanen. Kriterierne for tryksager er et omfattende dokument, som det er krævende at arbejde med, og som stiller store krav til licensansøgeren. I dokumentet ligger implicit en afvejning af, hvilke faser og processer der er mere eller mindre væsentlige ud fra et miljømæssigt synspunkt, men også en afvejning baseret på det muliges kunst i forhold til hvad den aktuelle teknologi og markedet kan følge med til.

Der har i de senere år været livlige diskussioner omkring revisionerne af kriteriedokumentet, idet der er forskellige opfattelser af, hvordan vægten og formuleringen skal være for de mange krav, der ligger i dokumentet. Disse diskussioner er en væsentlig årsag til, at projektet blev igangsat. Ved at gennemføre en fuld livscyklusvurdering med nyeste data og UMIP-metoden blev det muligt at få et opdateret indtryk af miljøbelastningerne ved produktion af tryksager, og dermed også et oplæg til en fornyet vurdering af, om vægtingerne i Svane-kriterierne er dækkende for den tilgængelige viden.

En anden væsentlig årsag, til at projektet blev igangsat, er at EU har igangsat udvikling af det første kriteriedokument for Blomsten for tryksager. Ved at gennemføre nærværende projektet kan Danmark give et væsentligt bidrag til det faglige grundlag for Blomsten samt til at harmonisere Blomst- og Svane-kriterierne.

## Hvad viser en livscyklusvurdering?

Resultaterne af en livscyklusvurdering kan give et billede af, hvor miljøbelastningen af et produkt er mere eller mindre betydende. Metoden er den eneste, der giver mulighed for at se og vurdere denne afvejning af belastningen i hele produktets livsforløb fra råstofudvinding over produktion, forbrug og bortskaffelse. UMIP-metoden er en internationalt anerkendt metode til livscyklusvurdering udviklet i Danmark i 1990'erne, som har været benyttet i dette og en lang række andre danske og internationale projekter.

## Hovedkonklusioner

Projektets væsentligste konklusioner kan udtrykkes i følgende:

- Inddragelse af data for kemikalier i LCA i højere grad end i tidligere undersøgelser giver en anderledes miljøprofil for tryksagen end hidtil
- De gennemførte analyser lægger derfor op til ændringer i det kommende kriteriedokument for Svanen. Dette gælder både for vægtningen af krav til råvarer og processer i relation til den samlede produktionsproces og inden for de enkelte afgrænsede procesled
- Resultaterne fra LCA-studiet giver et fundament for etablering af et kriteriedokument for EU's miljømærke, Blomsten, for tryksager (arkoffset)
- Resultaterne fra LCA-studiet gør det muligt for grafiske virksomheder at målrette deres leverandørsamarbejde på miljøområdet på et bedre vidensgrundlag end tidligere, ligesom de virksomheder, der arbejder med standardiserede miljøledelsessystemer, har fået et forbedret værktøj til at udpege de væsentligste miljøpåvirkninger

I den grafiske branche produceres en meget stor del af tryksagerne på virksomheder, der har miljøledelsessystemer og miljømærkelicenser, og der bruges mange ressourcer på miljøarbejde i disse virksomheder. I lyset af disse kendsgerninger bliver det endnu mere vigtigt både for den enkelte virksomhed og samfundet som helhed, at disse ressourcer anvendes så optimalt som muligt ved at styre de væsentlige miljøparametre. Med resultaterne fra dette projekt vil de grafiske virksomheder fremover kunne tilrettelægge deres miljøarbejde og anvende deres ressourcer til langt større gavn for miljøet end tidligere, ligesom den enkelte virksomhed vil få et mere udbygget troværdighedsgrundlag at foretage sin miljømarkedsføring på.

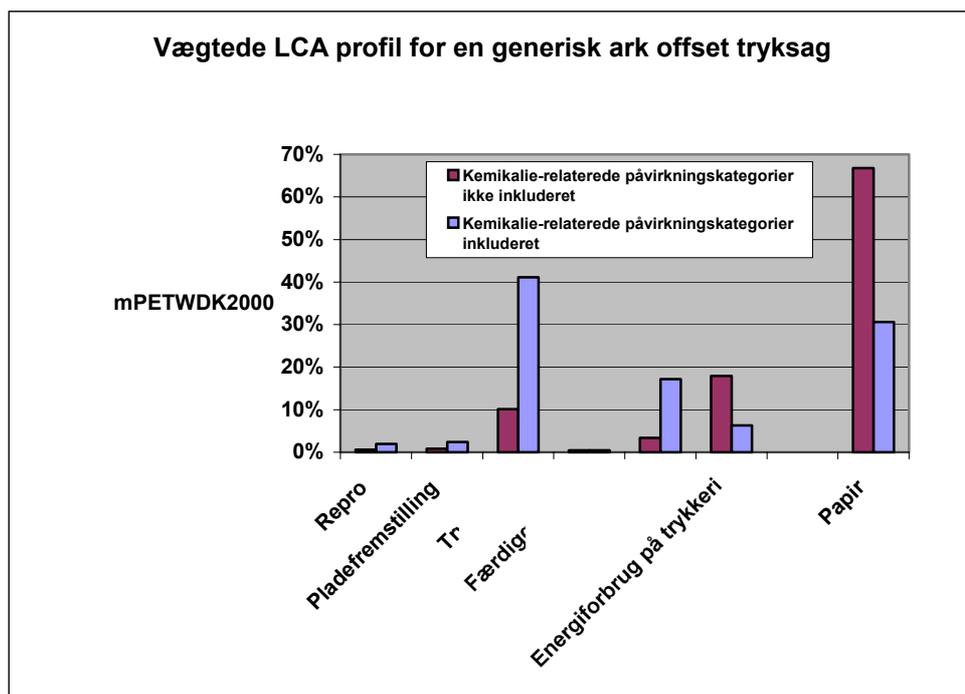
Projektet er afrapporteret i to rapporter: En rapport der beskriver selve LCA-studiet, og en rapport der dels beskriver konklusionerne for LCA-studiet og dels synergieffekter mellem miljøledelse og miljømærkning.

## Projektresultater

### *Livscyklusvurdering af produktion af tryksager*

Formålet med denne undersøgelse har været at identificere fordelingen af miljøpåvirkninger fra hele livscyklussen af en gennemsnitlig tryksag produceret ved arkkoffset metoden. Den funktionelle enhed har været 1 ton tryksag.

Bidraget til miljøpåvirkningerne er præsenteret opdelt på de forskellige faser i fremstillingen af tryksagen og på UMIP-metodens påvirkningskategorier. Papir er skilt ud, fordi tidligere LCA-studier har vist, at papir er den dominerende miljøfaktor for tryksager. Men dette projekt har vist, at hvis man inddrager kemikalier mere fyldestgørende, så bliver selve trykkeprocessen, inklusiv trykfarverne mere betydende (41%) end papir (31%), se figur nedenfor. Ud fra en ressourcebetragtning er papir stadig dominerende med 48%, især pga. det høje energiforbrug ved papirproduktion, se figur 16 i rapportens del II.



Resultaterne vurderes at dække såvel en gennemsnitlig nordisk som europæisk tryksagsproduktion ved arkoffset-metoden. Ud over referencescenariet blev der i projektet udviklet syv andre scenarier og diverse følsomhedsanalyser, hvor der i forhold til referencescenariet blev varieret på forbrug, emissioner, metoder osv.; data anvendt i scenarierne er bl.a. baseret på undersøgelser på nordiske offset-trykkerier, som fremgår af tabel 2 i projektets Del II rapport. Dette gav anledning til følgende konklusioner for den samlede miljøpåvirkning inkl. papir:

- Ved at inddrage spildevandsrensning med biologisk rensning kunne miljøpåvirkningen reduceres med ca. 26%
- Ved at reducere trykfarveforbruget fra 26,5 kg til 1,8 kg kunne miljøpåvirkningen reduceres med ca. 56% (forbrugstal fra publiceret svensk undersøgelse).
- Ved at substituere biocidet benzalkoniumklorid med biocidet Kathon (aktivstofferne er to isothiazolinoner), primært i de processer, hvor der recirkuleres vand, kunne miljøpåvirkningen reduceres med ca. 69% (uden spildevandsrensning)
- Miljøpåvirkningen reduceres med ca. 16%, hvis der udelukkende anvendes genbrugspapir i stedet for udelukkende jomfrueligt papir
- Miljøpåvirkningen reduceres med ca. 26%, hvis der udelukkende anvendes afvaskere baseret på vegetabilsk olier i stedet for udelukkende flygtige alifatiske afvaskere

LCA-studiet giver altså ikke blot et billede af fordelingen af miljøpåvirkningerne fra de forskellige faser og processer, men også – via følsomhedsanalysen – en indsigt i robustheden af konklusionerne. Fx kan det overraske, at der ikke er mere end 16% forskel imellem genbrugspapir og jomfrueligt papir, hvorimod det bliver tydeligt, hvor væsentligt det er at vælge det mindst miljøbelastende biocid, da forskellen her er 69%.

Det skal dog her bemærkes at LCA-studiet, som typisk for livscyklusvurderinger, ikke omfatter arbejdsmiljø og derfor heller ikke eventuelle arbejdsmiljø-

mæssige konsekvenser af f.eks. kemikaliesubstitution. Disse forhold må derfor vurderes separat.

Visse problemstillinger har det ikke været muligt at behandle fuldt ud på grund af især datamangel. Selvom det umiddelbart vurderes, at inddragelse af disse forhold sandsynligvis ikke vil ændre det overordnede resultat, kan en betydning ikke helt udelukkes:

- Andre opstrømskemikalieemissioner, fx andre end de inkluderede til produktion af trykfarver
- Afgasning af metan fra deponering af papir i det omfang, papiret ikke bliver genbrugt eller forbrændt. Mængden af metan, der ender i atmosfæren, kendes ikke
- Endelig bortskaffelse af kemikalieaffald

#### *Revision og etablering af miljømærkekriterier samt leverandørers miljøvaredeklamationer*

I forhold til kriterierne for tryksager under Svanen og de hidtidige LCA-studier viser det nye studie, at fordelingen imellem miljøpåvirkningerne fra tryksager produceret ved brug af arkoffset-metoden er anderledes end hidtil antaget.

##### - Struktur

En analyse af kriteriedokumentet viser, at den nuværende form ikke konsekvent stiller krav til samme relevante stoffer processerne igennem. Derfor foreslås en ændret og mere stringent struktur for dokumentet, hvor kriterier sættes generelt for forskellige stoffer og stofgrupper og derefter kan afviges (strammes eller lempes) for specifikke processer eller materialer.

##### - Manglende viden

Manglende viden er identificeret inden for følgende områder:

- Skal der fokuseres på valg af trykfarvetyper, eller skal der i stedet fokuseres på renere teknologi og emissionskontrol?
- Hvor kan der spares energi i livscyklus for en tryksag?
- Er det muligt at sætte kriterier op for transporttydelser?
- Er vægt den rette funktionelle enhed, eller bør det i stedet være parametre som f.eks. trykt overfladeareal?

##### - Etablering af databaser

For miljømærkeordningerne vil der være fordele ved at opbygge simple LCA-databaser fx for hver produktgruppe eller trykmetode. Sådanne data vil med tiden gøre det lettere at vurdere konsekvenser af fx substitution og reduktion i emissioner. Med et fælles LCA-datagrundlag vil også integration med andre produktorienterede ordninger fx miljøvaredeklamationer blive nemmere.

##### - Eksisterende miljøvaredeklamationer

Paper Profile er en miljøvaredeklamation, som papirbranchen i Norden har udviklet. Denne ordning omfatter de væsentligste relevante emissioner og krav om energiopgørelse, men set i et LCA-perspektiv kan det konstateres, at denne ordning ikke medregner energi, produceret internt fra overskudstrø, og hvad angår emission af kemikalier kun medtager AOX. Yderligere ses det, at denne deklaramationsordning fremstår som en ISO 14020 type III-ordning (tredjepartsvurderet), men da dette ikke fuldt har kunnet verificeres, må det

antages, at denne nærmere må betragtes som en type II-selvdeklarering. En integreret ordning, som på samme faglige LCA-grundlag kunne bruges som en type II-, III- og I-ordning ville være en stor fordel.

#### - Kemikalier opstrøms

Det kan ofte være vanskeligt at få data for kemikalier brugt "opstrøms" i produktionen. Årsagerne til dette begrundes ofte med produktionshæmmeligheder, ligesom de fleste af leverandører til den grafiske branche i Danmark er udenlandske og har en anden tradition for og opfattelse af, hvad der bør gives af miljøoplysninger. I dette studie er udledningsdata ved produktionen af pigmenter derfor estimeret ved hjælp af en ny metode til estimering af opstrømskemikalieemissioner udviklet på DTU. Dette har konkret vist sig at have væsentlig betydning (17%) for resultaterne af livscyklusstudiet.

#### *Leverandørkædesamarbejde og synergieffekter ved inddragelse af miljømærker i miljøledelsessystemer*

I projektets sidste del er erfaringer fra danske grafiske virksomheders arbejde med miljøledelse og Svanen gennemgået. Erfaringerne tager udgangspunkt i de mere end 50 grafiske virksomheder, der har et certificeret miljøledelsessystem og samtidig for de fleste vedkommende også en licens til svanemærkning.

Resultaterne er beskrevet systematisk ved først at beskrive erfaringer for henholdsvis miljøledelse og miljømærkning, derefter en række sammenvirkende effekter, der typisk er opnået ved inddragelse af svanemærkekriteriet i miljøledelsesarbejdet og vice versa, og afslutningsvis gives en række forslag til produktorientering af miljøledelsessystemer.

De udvalgte eksempler på synergieffekter miljøledelse og miljømærker imellem, der beskrives er:

- Miljøstrategi
- Miljøforhold, væsentlige påvirkninger og indsatsområder
- Vurdering af råvarer – spild
- Vurdering af produktionsudstyr
- Forbrug af råvarer
- Rådgivning af kunder
- Audit og kontrol

På trods af en vis divergens mellem væsentlige miljøforhold udpeget i miljøledelsessystemer i almindelighed og væsentlige miljøforhold, som fremgår af kriteriedokumentet for Svanen, kan det konstateres, at der opnås en væsentlig synergi til gavn for miljøet, hvis man anvender kriteriedokumentet som udgangspunkt for miljøledelsessystemet på ovennævnte områder. Det vurderes, at det gennemførte LCA-studie vil styrke dette yderligere.

Resultaterne har løbende i projektprocessen været inddraget i Det Svenske Standardiseringsinstituts arbejde for Europa Kommissionen med henblik på at udarbejde et kriterium for et Europæisk miljømærke for tryksager. Generelt har anvendelsen af miljøledelsessystemer i grafiske virksomheder i Europa en vis udbredelse, hvorfor det må antages, at et kriteriedokument for miljømærket Blomsten med baggrund i erfaringerne fra Danmark vil kunne få en understøttende positiv virkning på miljøet i forbindelse med grafisk produktion i

Europa. Danmark vil med dette arbejde kunne medvirke til en positiv udvikling på markeder, der er langt større end de nordiske.

*Andre kilder*

[www.miljonet.org](http://www.miljonet.org)

[www.ecolabel.dk](http://www.ecolabel.dk)

[www.paperprofile.com](http://www.paperprofile.com)

[www.lca-center.dk](http://www.lca-center.dk)

[www.ga.dk](http://www.ga.dk)

# 1 Introduction

Eco-labelling schemes, type I, following the ISO standards (ISO 14020 and ISO 14024) have been established in a number of regions over the last 10-15 years. This project covers the Nordic Swan Scheme and draws on experience through 8 years with the Criteria Document on Printed Matter.

## 1.1 Outline of the present Swan Criteria Document for Printed Matter

The documentation for the criteria in the existing Swan Criteria Document for Printed matter (Nordic Ecolabelling, version 3.1) is the background document from Nordic Ecolabelling from 2001 (SFS 2001). This document serves as documentation for the criteria revision process leading to the present criteria document. However, the background document is not a scientific report, and is based mostly on the two Swedish technical studies. The background document is focussed on the two Swedish technical studies (technical background documents) by Brodin and Korostenski (1995, 1997), an investigation of data from 360 printing industries in the Nordic countries, and a number of other studies, including an LCA study on printed matter from 1995 (Dalhielm & Axelsson 1995). Thus, the life cycle approach is included implicitly, but neither in a systematic nor comprehensive way, as also reflected by the fact that three other LCA studies from the 1990'ties (Axelsson et al. 1997, Drivsholm et al. 1997, INFRAS 1998) are not mentioned.

The technical background documents by Brodin and Korostenski (1995, 1997) cover results of questionnaires to about 150 Swedish printing industries (60 sheet fed offset) on key figures for emissions and consumptions. The resulting proposed eco-labelling criteria in these documents are, therefore, mainly based on a combination of key figures and environmental regulatory demands on single emissions, dangerous chemicals etc. This focus seems also to be the main fundament of the existing Swan Criteria Document for Printed matter (Nordic Ecolabelling, version 3.1). A short description of the two technical background documents by Brodin and Korostenski and the existing Swan Criteria Document is enclosed in Annex A.

## 1.2 Structure of this report

- Section 2 is a comparison between LCA results and the Swan Criteria Document
- Section 3 is a comparison between LCA results and the Paper Profile provisions as defined in the Manual for the scheme.
- Section 4 is a description of supply chain collaboration and the synergy effects of incorporating environmental labelling into environmental management systems.

1.3 Short presentation of the scenarios of the report part II, "Ecolabelling off printed matter – Life cycle assessment of model sheet fed offset printed matter" Inventory data used in the reference scenarios in the report part II, "Ecolabelling off printed matter – Life cycle assessment of model sheet fed offset printed matter" is based of the production stage of a generic printed matter

produced at a model sheet fed offset printing company. The raw materials for the production stage included in this generic study are the dominant types typically used in 'traditional' sheet feed offset, i.e. film, film developer, fixer, biocides, plates, plate developer, gumming solution, paper, alcohol (isopropyl alcohol, IPA), printing ink, fountain solution, lacquer (varnishes), glue and cleaning agents.

The inventory data described above are used in the reference scenario, and in continuation to this reference scenario also a number of alternative scenarios based on the reference scenario but with changes in some of the parameters, were carried out. These were:

- Scenario 1: Average energy
- Scenario 2: Saturated paper market
- Scenario 3: Variation in paper spillage
- Scenario 4: Variation in printing ink consumption
- Scenario 5: Waste water treatment included
- Scenario 6: Alternative biocide agent for rinsing water
- Scenario 7: No waste water emitted

## 2 Focus and methodology for Eco-label Criteria

This Section covers a comparison between LCA results and the Swan Criteria Document on Printed Matter, version 3.1 (see <http://www.svanen.nu/DocEng/041e.pdf>). The Section is structured in the following Chapters:

- In Chapter **2.1 – 2.3** goal, scope, input and activities for the Section are described.
- In Chapter **2.4** an overview of the present Swan Criteria Document is given, with focus on the weights estimated from the criteria.
- In Chapter **2.5** this weighting is then compared to the weighting indicated from LCA studies.
- This comparison is then discussed in Chapter **2.6**, and with further aspects in Chapter **2.7**.

### 2.1 Goal

The goal is to carry out an assessment of the methodology used for criteria development under the Nordic Swan, and suggestions for methodology to be used for the criteria development under the European Flower are elaborated. The study takes its starting point in the Swan criteria, which is now in its third revised version. The history goes back to 1996, where the first criteria document was drafted, thus providing much experience on the practical application of the criteria in the Nordic countries.

Regardless of this starting point, the present study is intended also as a background document targeted towards the development of the first version of criteria on printed matter under the EU eco-labelling scheme, the Flower.

### 2.2 Scope

The Swan Criteria Document for printed matter contains numerous criteria, defined in several ways. The core of the document is the point system, but this is supplemented with a long list of absolute (quantitative) requirements and qualitative requirements. In the present study, the point system and the list of absolute requirements are assessed in a comparable way. Qualitative requirements, such as documentation or testing requirements, are omitted from the study because the nature of such requirements makes them very difficult to measure and compare to other criteria.

The scope follows the scope of the Part II LCA study when it comes to coverage of the life cycle phases, processes and materials. This scope is at several points much wider than the coverage of the criteria document, which is an important part of the result of the entire project. The data for the scenarios of the Part II LCA study comes mainly from surveys of the Nordic printing industries (see for example Table 12 of the Part II report).

The focus in this section is on the weight of environmental issues and on the principles and the structure of the criteria document.

See the Part II LCA study for the precise definition of the scope.

The RPS approach used in both the Nordic and the European eco-labelling schemes, considering Relevance, Potential for change, and Steerability, has not been considered in this study. The focus has been on the environmental impact from various parts of the life cycle of 1 ton of generic printed matter, whereas the RPS approach covers market considerations. The RPS considerations are important when product groups are selected and criteria are developed or revised, because if either the market or the technology for improvement is not ready for the requirements in the criteria document, then the product group will not be a success – and then no environmental improvements will be possible. Thus, while a clear scientifically based criteria document may give the optimal result in theory, in reality it may not work.

### 2.3 Input and activities

The starting point for this study is the current version 3.1 of the criteria document for printed matter (printed paper products) under the Swan Scheme [Nordic Ecolabelling: Ecolabelling of Printed Matter, criteria document, version 3.1]. The results from the Part II study (new generic LCA) and relevant existing LCAs included in Part II and a summary of the experience from the history of criteria development towards the current version then forms the basis of the assessment. The relevant LCA references are referred from the Part II.

Based on the results of LCA studies and experience from the previous development of criteria under the Swan, suggestions for changes in focus, structure and methodology for the criteria have been elaborated and described. The suggestions are intended both for revisions of the Swan Criteria and for input to the criteria development under the EU Flower.

### 2.4 Overview of weighting in the criteria document compared to LCA results

The current criteria document is an example of criteria based on a point system. The point system makes it possible for the license holder to weight processes internally, thus, a badly performing process will be acceptable if one or more very well performing processes are available in other parts of the process line. Not all criteria are included in the point system, thus, the point system is supplemented with absolute requirements and obligations to monitor and report certain parameters.

Covering the point system only, Table 4.3 of the criteria document gives an overview of the weighting between process stages for each type of printing method. The weighting given in Table 4.3 of the criteria document has been extracted into Table 2.1 with point weights transposed into percentages.

Table 2.1 – Weighting in the Swan Criteria Document, point system criteria only (disregarding absolute criteria).

Printing method	Page production	Form production	Printing	Finishing	Total points score
Sheet feed	17%	8%	58%	17%	100%
Web offset (coldset)	17%	8%	58%	17%	100%
Heatset	15%	8%	62%	15%	100%
Rotogravure	17%	50%	17%	17%	100%
Flexography	22%	22%	33%	22%	100%
Digitalprint	-	-	-	100%	100%
Letterpress	15%	15%	54%	15%	100%

Taking sheet feed separately, which is the scope for this project, the total maximum score is 12 points, with a target value for printing of 7 giving the weight of 58% to this process. For a further analysis of the weighting, the subdivision of weighting in Table 4.3 of the criteria document is presented in Table 2.2. Sub-weighting is calculated by classifying point-giving criteria into issues, and summing up to maximum within each issue, and then normalising to the percentage of the parent heading.

Table 2.2 also contains the weight results from the Part II study, looking at environmental impacts and using the scenario without paper and energy consumption at the printing company. The weights in the point system are thereby comparable directly to the results of the Part II study.

Table 2.2 – Detailed weighting in the Swan Criteria Document, point system criteria only (disregarding absolute criteria), and compared to weighted results from the Part II study.

	Existing criteria		Part II study*
Sheet feed			
Page production	17%		3%
Rinsing solution treatment		17%	
Form production	8%		4%
Plate developing agents		8%	
Printing incl. Cleaning	58%		92%
Inks		12%	54%
Washing agents		20%	27%
Alcohol		17%	9%
Damping solutions		9%	2%
Surfactants (3%)			
Finishing	17%		1%
Lamination **		7%	
Lacquering		5%	
Adhesives		5%	
Total points score	100%	100%	100%

\* Reference scenario excluding paper and energy consumption at printing company (based on weighted potential environmental impact).

\*\* Not included in the Part II study.

Table 2.2 presents the weighting of criteria that are point giving. However, some criteria are absolute requirements, and these cannot be assessed percentage wise in relation to the point giving criteria, because an absolute requirement may be allocated a weight anywhere between almost zero to almost 100%. Therefore, no effort has been made to quantify absolute and point giving requirements in a combined assessment. In Table 2.3 the list of absolute requirements has been added to the point system list, providing an overview of all quantitative criteria as defined in the eco-labelling terminology. The reference scenario from the Part II LCA study, including paper and energy consumption at the printing company, has been chosen for comparison in this table because the absolute requirements on these issues from the criteria document have been included too.

This overview does not, however, cover the more qualitative requirements such as environmental assurance, quality, testing, marketing and documentation requirements. The purpose of such requirements is to put focus on issues such as energy consumption by implementing the registration of energy consumption, or organisation around the production by implementing organisational structure for reporting changes in the production to the eco-labelling body. Such criteria are not covered by the scope of this study.

Table 2.3 – Absolute requirements added to the point system list

Sheet feed offset	Existing criteria	Part II study@
Paper fulfils eco-label criteria	Req.	31%
Energy consumption of printing industry	-	6%
Page production	17%	2%
Collection of photographic chemicals and hazardous waste	Req.	Fulfilled
Silver in rinsing solution max. 10 mg/m <sup>2</sup>	Req.	Not fulfilled (42 mg/m <sup>2</sup> )
Rinsing solution treatment	17%	Not specified in the Swan criteria document
Form production	8%	2%
Collection of hazardous waste	Req.	Fulfilled
No silver based plates	Req.	Fulfilled
No solvent based agents	Req.	Fulfilled
Plate developing agents	8%	< 0.1%
Printing incl. Cleaning	58%	58%
Inks	12%	#34%
Washing agents	20%	17%
Max limits on washing (amount, aromatic content)	Req.	Fulfilled
Alcohol	17%	6%
Alcohol, max. 6 kg/tonnes	Req.	Fulfilled
Collection for destruction or recycling	Req.	Fulfilled
Wash or energy recovery of cloths	Req.	Not included
Treatment of waste washing water	Req.	Not included
Damping solutions	6%	1%
Surfactants	3%	-
Surfactants readily degradable	Req.	Fulfilled
Treatment of waste damping solution	Req.	Not included

Sheet feed offset	Existing criteria		Part II study@
Finishing	17%		<1% *
Wash or energy recovery of cloths and rags		Req.	Not included
Lamination		7%	Not included
Self-adhesive non-water soluble adhesives not allowed		Req.	Fulfilled
Lacquering		5%	0.3%
Adhesives		5%	0.1%
Production requirements			
Documentation on all chemicals		Req.	Not relevant
Washing agents, damping solution concentrates, damping solution additives and algecides, printing ink, overprint varnish, toner, adhesive, lacquer and laminate must not contain phthalates, nonylphenols (or derivatives of these), ethylene glycol ethers (Cas: 111-77-3, 111-90-0, 109-86-4, 110-80-5) or halogenated hydrocarbons		Req.	Fulfilled
Aromatic content of washing agents must be below 1%. Exception: 2% of total consumption may contain max. 50% aromatic.		Req.	Fulfilled
Biocides in damping solution must not be potentially bioaccumulable		Req.	Fulfilled
Printing ink, overprint varnish, toner, adhesive, lacquer and laminate must not contain a total of more than 2% by weight of substances classified as environmentally hazardous in accordance with EU Directive 67/548/EEC...		Req.	(Fulfilled**)
Pigments in printing ink/toner must not be based on heavy metals, aluminium or copper. Exception: copper phthalatocyanine.		Req.	Fulfilled
The content of the following heavy metals in printing inks, toners or ink must not exceed a total of 100 ppm: Lead, cadmium, mercury and hexavalent chromium		Req.	Fulfilled
Waste management requirements			
Cutting waste less than 20%		Req.	Fulfilled
Waste man. plan incl. sorting and handling		Req.	Not relevant
The licence-holder is required to sort and handle for processing of electronic waste		Req.	Not relevant
Aluminium printing plates and waste paper from production must be submitted for recycling		Req.	Fulfilled
Total points score	100%	100%	100%

@ In this column, "fulfilled" means that in the reference scenario of the Part II study this requirement is fulfilled a percentage indicates the weight on potential environmental impact derived from the study results and "not relevant" means that this is not included quantitatively in the study.

\* Lamination not included.

\*\* Printing ink contains more than 2% w/w of low volatile paraffin (mineral oil) with components (tetradecane) that according to the assessment done in the Part II study should be classified as hazardous for the environment.

# Emission of ink residues at the printing industry included: 16.5% (ink production) + 17.7% (ink emission)

As mentioned above, it is not feasible to transform absolute requirements into quantitative values, which could be added to the point system values. Taking, for example, the printing incl. cleaning value of 58%, which by coincidence is equal to the weight given by the Part II study, then there are seven absolute requirements supplementing this value, which gives the impression that printing incl. cleaning is actually overestimated in the Criteria Document's weighting. However, the seven absolute requirements have a different focus to that which is pointed out by the results of the Part II study.

The seven absolute requirements under printing incl. cleaning:

- Max limits on washing (amount, aromatic content)
- Alcohol, max. 6 kg/tonnes
- Collection for destruction or recycling
- Wash or energy recovery of cloths
- Treatment of waste washing water
- Surfactants readily degradable
- Treatment of waste damping solution

The focus given by the Part II study:

- Substances used in cleaning agents and inks

Furthermore, a number of the absolute requirements given later in the table under production requirements refer to parts of the printing and cleaning processes, but still they do not focus on substances used in cleaning agents and inks to an extent that meets the weighting of the results of the Part II study.

Thus, the existing LCAs included in Part II and the results of the Part II study indicate the importance of including new LCA stages/issues (e.g. energy consumption at printing company and transport) and a different weighting (e.g. on printing ink) if the criteria are to be based on a product LCA approach.

## 2.5 Weighting for each of the process stages

The results of the LCA study in Part II of this project are outlined as a weighted distribution of impacts from sub-processes (activities) in the Part II LCA study. Roughly the following seven sub-processes dominate the potential environmental impacts:

Paper production (31%)  
Printing (41%, thereof 17% points from ink production)  
Cleaning (17%)  
Energy at print (6%)  
Plate making (2%)  
Page production (2%)  
Finishing (<1%)

In the following, each of the process stages is covered. Requirements for the production processes are given in Section 4.3 of the criteria document.

### 2.5.1 Paper

Requirements for paper are given in Section 4.2 of the criteria document.

Paper can be regarded as part of the printing process (raw material for printing) but here is considered separately.

All studies referred to in Part II of this project (except the Part II study itself) find paper to be dominant in the potential environmental impact (typically 70 – 80% in importance). Even though paper is not overall dominating in the Part II study, it plays a very important role, accounting for about 31% of the aggregated weighted potential environmental impact. The main reason for this difference in importance of paper between the existing LCAs and the Part II study is probably that chemical related impact categories are included in the Part II study (making it more comprehensive) which is not the case or only to a limited degree in the existing LCAs. This difference in comprehensiveness does also have impact on the importance of the other activities, especially printing as described below. In the current criteria, paper is omitted from the point system, but with an absolute requirement of using Swan or Flower labelled paper or paper fulfilling one of these criteria documents. The weight of 31% from the Part II study is based on paper that fulfils these criteria.

If paper is not recycled (most important) and the heat from incineration not exploited, the importance of paper increases to above 48%. If, additionally, the paper is used for land filling (dumped), then the importance will increase significantly due to possible emissions of methane to air (contributing to global warming) from the anaerobic degradation of the cellulose in the paper.

### 2.5.2 Printing

All the existing LCA studies included in Part II point to the printing step as the second most important. However the Part II study points to printing (58%) as the most important step and only if both cleaning (17%) and ink production (17%) are excluded from the printing step does paper (31%) become most important. Other issues of importance at the printing step according to the Part II study include the possible emission of ink residues to water, emission of used fountain solutions containing biocides to water and emission of alcohol (IPA) to air.

These focus points call for demands on consumption (e.g. ink spillage reduction), substitution (e.g. pigments and biocides) and waste handling (e.g. for used fountain solutions).

### 2.5.3 Cleaning

The existing LCA studies included in Part II are not very specific on the importance of the cleaning step, however VOC emission from cleaning is pointed out as relatively important. The Part II study points to cleaning as one of the important steps, accounting for 17% of the total aggregated potential environmental impact. Emission of solvents from cleaning agents based on mineral oil is dominant.

This focus point calls for demands especially on substitution but also consumption and waste handling.

#### 2.5.4 Ink production

Generally only energy consumption from ink production is included in the existing LCAs included in Part II. On this basis the importance is relatively low (typically around a few percent). However the Part II study comes up with a 17% importance of ink production mainly due to emission of synthesis chemicals during the production of pigments.

This focus point calls for demands especially on ink consumption (ink spillage) and substitution.

#### 2.5.5 Energy consumption

Energy consumption at the printing company is typically not shown separately in the existing LCAs included in Part II. However it is shown in one case for sheet fed offset but only covering the printing process and accounting for below 1% in each of the energy related impact categories included. In the Part II study the total energy consumption at the printing company gives rise to an importance of 6% of the total aggregated weighted potential impact, also including chemical related impact categories.

This focus point calls for demands on energy consumption combined with demands on energy source.

#### 2.5.6 Page production

The existing LCAs included in Part II either do not include page production (repro) or do not show its importance separately (only stating that the importance is small). However for the sheet fed offset case a category designated "film and film chemicals" accounts for 1% - 6%, depending on which of the energy related impact categories is looked at. In the Part II study repro accounts for about 2% of the total aggregated weighted potential impact also including chemical related impact categories.

This focus point calls for demands on, for example, substitution (e.g. hydroquinone) and cleaner technology.

#### 2.5.7 Plate making

For plate making the existing LCA studies included in Part II, for which this process is shown separately, estimate an importance for plate making of about 5% (1% - 13% depending on energy related impact category). The Part II study assigns plate making an importance of about 2%, assuming that the aluminium plates are fully recycled (only 8% loss) and allocate the avoided energy consumption from production of virgin aluminium to the plate making process. If production of 100% virgin aluminium is used instead, the importance of aluminium in the Part II study becomes about 4%, which is more at the level of the existing studies. However the main contributor to plate making in the Part II study is emission of biocides via used recycled rinse water, accounting for about 1.7%.

These focus points call for demands on, for example, substitution (biocides), waste handling including consumption and recycling of aluminium plates.

## 2.5.8 Finishing

Finishing is not included or shown explicitly in the existing LCA studies being part of the LCA study, Part II, – at least not in a quantitative way that would make it possible to estimate a relative importance. However one of the studies indicates that it may have significant importance in some cases (e.g. energy consumption at bookbinding). Bookbinding and lamination is not included in the Part II study and the importance of finishing is estimated to about 0.4%.

## 2.6 Discussion related to the criteria document

The earlier LCA studies and the Part II study indicate that, disregarding paper, some issues, left out of or given low priority in the criteria document, might be included or have a greater weight. In this section, each of the process stages covered in Section 2.5 and a few more themes are discussed in relation to the Swan Criteria Document.

### 2.6.1 Paper

#### *2.6.1.1 Paper waste in production*

Existing LCA studies included in Part II indicate that, excluding paper production, the paper waste in the production becomes third most dominant factor on global warming.

The Part II study shows that assuming a reduction in the paper waste from 32.1% to 3.3% reduces the total weighted aggregated environmental impact by 11%, as shown by this study with Nordic printing houses, (see for example Table 12 of the Part II report).

In Section 4.3.10 of the criteria document, paper waste has a general requirement of maximum 20%. This covers only cutting waste. Besides this, waste paper will be generated from start-up/calibration of printing machines, but this is not included in the current criteria.

Demands on paper cutting waste (20%) should be changed. Demands on waste paper in general (including waste sheets etc.) should be included.

As this parameter goes hand in hand with economy, printing companies have interest in this already.

Methods for optimisation of paper use are a matter of both planning and technology. Also, classification of processes and equipment types would make it more feasible to specify realistic paper waste fractions in total (cutting waste and upstart/calibration paper waste).

#### *2.6.1.2 Disposal for recycling or incineration*

The Part II study shows that recycling and exploitation of heat from incineration of paper waste is very important for the LCA profile.

There is a general clause in Section 4.4.2 about sorting waste and sending all fractions for best treatment, such as recycling.

The general requirement in Section 4.4.2 of the criteria document may not be feasible for improvement, because waste treatment depends mainly on local and regional policies and capabilities for optimal treatment.

If paper is land filled, it will develop methane, which contributes to global warming (if not captured and used for energy production), thus, markedly increasing the impact from paper.

#### *2.6.1.3 Use of recycled paper*

The reference study (i.e. the reference scenario in the Part II study) is based on the current situation today, i.e. an unsaturated paper market situation. Combining this with the marginal approach, also used in the reference scenario, leads to the immediate result that there is no difference in the impact from printed matter produced on virgin paper basis as compared to printed matter produced on basis of recycled paper. However, a special scenario (also done in the Part II study) shows that if a saturated paper market is assumed, then changing consumption from fully virgin paper based to fully recycled paper based results in a reduction of 16% in the total weighted environmental impact. So, even though the paper market is unsaturated today, the use of recycled paper is very important from an overall societal point of view (keeping the recycling system at work).

Points may be given for the use of recycled paper.

### **2.6.2 Printing**

Printing has 58% weight in the criteria document, which is mainly allocated to inks, washing agents and alcohol. Furthermore, much energy and many chemicals are used in the printing process.

In Section 4.4.1.3 of the criteria document, only 2% hazardous substances, no heavy metal based inks, Pb, Cd, Hg and Cr (VI) below 100 ppm, no phthalates, nonylphenoles, ethylene glycol ethers and halogenated hydrocarbons are allowed. There are in general no criteria relating to upstream production of chemicals.

The Part II study also gives 58% weight to printing, but for other reasons, especially because of the inclusion of upstream data for ink production, as further detailed below.

Printing issues are dealt with in further detail below under cleaning and ink production, and under energy issues.

### **2.6.3 Cleaning**

In the Part II study, cleaning accounts for 17% of the total aggregated potential environmental impact. This high weight is due to emission of solvents from cleaning agents based on mineral oil. Criteria for cleaning/washing agents are given in the criteria document in Section 4.3.3. Even though detailed criteria are given to the vapour pressure of washing agents and to the content of aromatic compounds, this is not enough to minimise the potential environmental impacts from cleaning. This is due to inconsistency in the criteria document as further discussed later in Section 2.6.14:

The requirements on classified substances are related to Section 4.4.1.3 regarding chemicals ending up in the product (inks, varnishes, toners etc.), not washing agents. Point-giving criteria on washing agents focus on vapour pressure and aromatic content as mentioned above, but not on substances, which should be classified as environmentally hazardous.

## 2.6.4 Ink production

Inclusion of emissions from use and production of other chemicals, especially inks, in the Part II study increases the importance of this phase. In the existing studies ink has an overall weight of about 10% (including paper).

- The Part II study indicates that the production of pigments/inks implies relatively high potential impacts within the impact category for eco-toxicity (totally 17% with paper included) especially. Assuming a reduction in the printing ink consumption (e.g. by reducing the ink spillage) of 26.5 kg/ton product to 1.8 kg/ton products reduces the total potential environmental impact by 56% (see for example Table 12 of the Part II report). (see for example Table 12 of the Part II report).

In Section 4.3.3 of the criteria document, UV inks are given 2p, while other inks are given 1p or 0p.

Inks in general may be given more weight. Or common inks may be assessed content wise and criteria may be defined in further detail about better and worse ink components.

The Part II study indicates that the emissions from production of inks/pigments have high potential impact. Criteria will focus on spillage reduction of the printing company and requirements to suppliers of inks.

This will call for a lot of assessment on chemical products, and for building up databases on inks in a co-operation between the Eco-labelling Bodies and others such as the suppliers.

A further study will be needed to identify if criteria should focus on the choice of ink types or ingredients or on cleaner technologies and emission control.

## 2.6.5 Energy consumption

Energy consumption in the production (page production, form production, printing and finishing) is included in most studies. The weighted LCA profile on potential environmental impact for the Part II study indicates a 6% share for this energy consumption. Furthermore, the study indicates dominating resource pulls for coal, oil and gas as a result of the processes' energy usage.

In Section 4.3 of the criteria document, there are in general no criteria on energy consumption in the production phases. (Except for standby level for digital printing devices (4.3.8 in the criteria doc.), which are outside the scope of this study.)

Points may be given for energy consumption in the printing machinery and the various sub-processes and auxiliary consumption, such as lighting, ventilation and room heating. Another focus point could be moistening. Low points may be given for low consumption and for the documented use of "green energy", such as wind or water energy.

Further studies on possibilities for optimisation of energy consumption in the relevant processes will be needed.

### 2.6.6 Page production

The Part II study indicates a weight of 2% of the total aggregated weighted potential impact, which is mainly related to the use of some hazardous chemicals, which could be covered in future requirements on chemicals as discussed in Chapter 2.6.14.

### 2.6.7 Plate making

Existing LCA studies included in Part II indicate that, excluding paper, this sub-process becomes dominant on global warming. This is mainly due to the high-energy consumption in the production of aluminium. The Part II study shows only a 2% share of the total weighted potential impact for this sub-process.

In Section 4.3.2.1 of the criteria document, little weight has been given to the requirements on aluminium plates used in the sub-process.

More weight may be given to aluminium plates in this process stage.

No new parameters (apart from energy consumption) are to be developed here, only adjustment on weights. As the market value of secondary aluminium from plates is high, the recycling of aluminium plates is already at a high level.

### 2.6.8 Finishing

Finishing has a very low weight in the Part II study and is not further discussed here.

### 2.6.9 Transport

Existing LCA studies included in Part II indicate that, excluding paper, this sub-process becomes second most dominant on global warming, or around 10% on the overall impact. Transport is not included explicitly in the Part II study and only in the material phase. The results show, for example, that transport during paper production amounts to about 2% of the total LCA global warming potential. It is assessed that the importance of transport is about 5% when chemical related impact categories are included as in the Part II study.

No criteria have been set up for transport processes.

Points may be given for transport (paper to printing company, semi-products in the production chain, waste to treatment facilities, product to customer). No criteria have been set up for transport processes in the current criteria document. This is a totally new area, which calls for assessment of the market situation and steerability. Registrations of geography of supplier, waste treatment facilities and customers will be necessary.

### 2.6.10 Waste water treatment

The Part II study indicates that including wastewater treatment (e.g. municipal WWTP) may reduce the total weighted environmental impact by 26%. The degree of implementation of WWTP in EU-25 is depending on each country's plan for WWT and the method of WWT within Europe.

### 2.6.11 Substitution of biocide

The Part II study indicates that substituting a biocide like benzalkonium chloride with an isothiazoline based (i.e. Kathon) type may reduce the total weighted environmental impact by 21% (WWTP included) or 69% (WWTP excluded). As within EU-25 WWTP is not very well established, substituting benzalkonium chloride with an isothiazoline based biocide should be assessed properly in relation to workers environment.

### 2.6.12 Weighting on resource pull

Results from the Part II study point to kaolin as the main resource pull from printed matter. Kaolin is used in paper production and may be substituted by chalk, giving a lower profile. Omitting kaolin, the important resource pulls are related to energy consumption (oil, natural gas and some heavy metals (Ni, Cu, Cr), and uranium from other energy scenarios under cleaning and finishing), silver for repro and to the use of aluminium for plates.

These results stress the importance of focussing on energy consumption as mentioned above.

### 2.6.13 Qualitative requirements

As mentioned earlier, a number of qualitative requirements are excluded from this assessment. Requirements for documentation and declarations from authorities are important for the overall focus, environment and good house-keeping is given by such criteria, but it has not been possible to cover them in the present study.

### 2.6.14 Chemicals

Compared to the results of earlier studies with less focus on chemicals, the printing and cleaning processes are much more dominant in the Part II study results, which is mainly due to high potential impacts on eco-toxicity coming from production, use and discharge of inks and emissions of cleaning agents and biocides during use.

The criteria document contains a number of absolute requirements for substances, mostly given in the general section for production, under chemicals (Section 4.4.1). These criteria specify properties covering:

- phthalates
- nonylphenols and derivatives
- ethylene glycol ethers
- halogenated hydrocarbons
- aromatic content
- biocides
- surfactants
- classification as hazardous substance
- content of heavy metals, aluminium and copper

The reference scenario in the Part II study is based on the use of raw materials meeting the existing criteria in the Swan Criteria Document, and many of them even far better than the requirements in the criteria. An example is the aromatic content in washing agents, which is required as lower than 50% for maximum 2% of the yearly consumption and less than 1% for the remaining 98% of the yearly consumption. In the reference scenario, the aromatic content is equal to or lower than 0.1%. On the other hand, whereas biocides in the damping solution are not bioaccumulable, as required, then typically bioaccumulable components in inks and washing agents are used in the reference scenario. This property contributes to and is part of the explanation for the high potential impacts from printing and cleaning.

Most dominant, however, is the toxic effect part of eco-toxicity contribution from the emission of high volatile paraffins (i.e. hexane) and low volatile paraffin's (i.e. tetradecane) used for washing, and emissions of cuprous chloride and dichlorobenzidine from the production of pigments for inks.

Hexane and tetradecane are not covered by the criteria document maybe because they are part of mixtures and here chosen to represent a mixture of high volatile solvent and a mixture of low volatile solvent respectively. The requirements for classified substances are related to Section 4.4.1.3 regarding chemicals ending up in the product (inks, varnishes, toners etc.), not washing agents. Point-giving criteria on washing agents focus on vapour pressure and aromatic content, but not on substances, which should be classified as environmental hazardous. This is an example of the criteria document not being consistent when it comes to chemicals accepted in the life cycle of the product.

Emissions from production of chemicals are in general not considered for the criteria document. This is a general situation in eco-labelling. The knowledge and data availability on this issue is limited, and a consensus on methodology is lacking. However, the result of the estimation method included in the Part II study shows that the importance of upstream emissions may be very significant for the outcome of a product life cycle assessment. Studies conducted on the basis of the EDIP methodology are part of the leading research in this field and data are becoming more available during these years, which is why it has been possible in the Part II study to include a reasonable coverage of this, taking the present data availability into account. Thereby, emissions of cuprous chloride and dichlorobenzidine are examples of emissions that appear in the LCA of printed matter when the production phases of chemicals are included, and the Part II study reveals the importance of this issue for the life cycle of printed matter. A new study including measured (not estimated) emissions from upstream chemical production would most probably strengthen the reliability of the LCA profile for printed matter substantially.

## 2.7 Methodological Discussion

This section covers discussions of more principal and methodological nature, which are not directly targeted at the process stages or the criteria documents.

### 2.7.1 Functional unit

If a life cycle approach should be a unifying principle in the criteria document, then all amounts should in principle relate to production volume (i.e. using the same functional unit). For example, limits of a substance discharged to sewers of X kg/year for a production site should be changed to Y kg substance

discharged/kg produced printed matter. Thus, all requirements are unified into covering the same kind of product, and so are comparable. However, there is an important discussion around this issue: If all requirements are set by weight of product, then reducing paper thickness will have the opposite effect, namely that, for example, the use of chemicals per weight unit will increase, drawing a negative picture of change, even though the total environmental impact is reduced due to reduction in paper consumption. This illustrates the problem of choosing a good functional unit for printed communication. However, in this case, the positive effect will most probably be reflected in an LCA profile.

A way to overcome this problem is to base all requirements on area of paper printed. Thus thinner qualities will be positively rated, and so will printing on both sides. However, this approach has some other disadvantages, for example, some calculations have to be carried out from specifications of the individual machine, the cylinder format and the number of printing units, as well as the number of runs/cylinder revolutions (Bagh et al. 2002). But these problems may be solved by setting up standard categories of paper and providing standard calculation routines for estimating the area.

Another suggestion is to base some parameters directly on amount of ink used, which would create an incentive to minimise this amount.

### 2.7.2 Waste treatment issues

In general, waste treatment processes are left out of generic LCA studies because relevant LCA data do not exist. For a European criteria document, however, it may be considered to carry out a study on the overall potential impact from emitting waste (e.g. used rinsing water with biocide content emitted to waste water treatment plant) as compared to treating waste as chemical waste, i.e. disposal under controlled conditions at chemical waste treatment facilities. Such an investigation would probably elucidate the pros and cons of different waste disposal strategies.

Criteria on discharge of damping water and rinsing water should be based on legal provisions of the region. If a well functioning wastewater treatment plant is available, the local authorities may very well permit discharge through the common sewer. Whereas in other cases, the correct procedure would be to collect the same fractions and classify it as chemical waste for treatment at a specialised plant. This discussion is complex and dealing with it will require a huge data collection on treatment culture in all relevant regions.

### 2.7.3 Structure of the criteria document

Traditionally in eco-labelling, criteria documents are structured like the present Swan document for printed matter. First criteria are set for the various specific processes covered by the definition of the product group. Then this is supplemented with criteria for various cross-disciplinary issues like auxiliary chemicals, testing, management and marketing. When chemicals are in focus as indicated by the Part II study, this approach is not optimal, because it may be difficult to keep track of all requirements set on chemicals across the document.

Therefore, another approach, suggested here, is to establish a basic section of requirements for chemicals, and then build, on top of this base, further requirements for specific processes, see Figure 2.1. The advantage of this ap-

proach would be that requirements set on one chemical are global for the criteria document. Thus, the risk of setting requirements for a substance in one section and on the other hand allowing the same substance in another section will be minimised. When adding process specific requirements to this base, it will be quite clear if the requirements for a substance or a group of such will increase or decrease (adding an exception for a process).

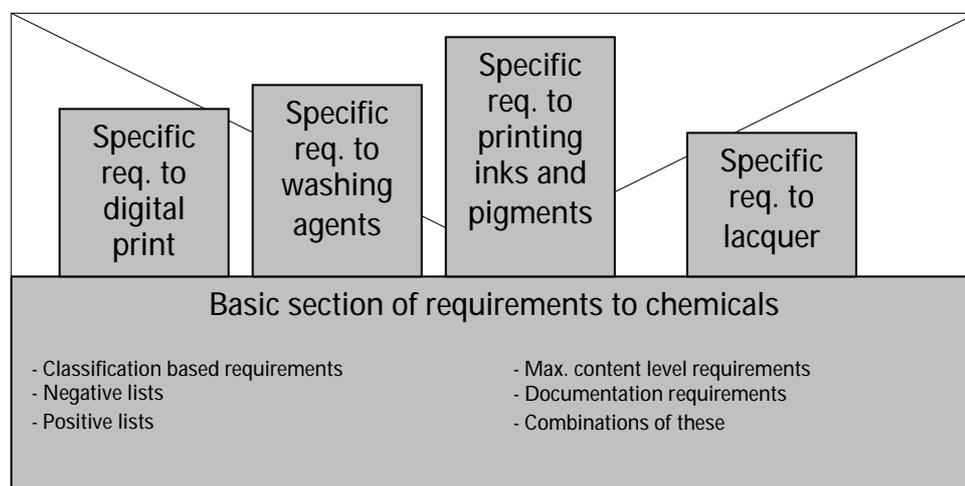


Figure 2.1 – Outline of an approach where requirements for chemicals are given commonly as a base, which is then built upon for each process. The approach outlined in Figure 2.1 may also be adopted for other issues, for example, requirements for waste handling or transportation.

#### 2.7.4 Structure across the eco-labelling scheme

Even in stepping up a level from the specific criteria document on printed matter to the entire eco-labelling scheme (e.g. the Flower) the approach outlined in Figure 2.1 may still be relevant. Some stakeholders around the eco-labelling schemes for different regions have often put forward the problem derived from the fact that criteria for specific chemicals in different criteria documents vary a lot. Thus, lead, for example, may be banned in one document and accepted at a certain level in another document. This is of course due to differences in processes and use patterns for lead in the two cases. However, the result for the eco-labelling scheme as such is a much more difficult job in promoting the scheme and explaining to consumers the advantages of the labelled products compared to conventional products: There is no clear message to the consumer, such as “there will be no lead in eco-labelled products”.

A way to more systematically deal with cross-disciplinary criteria on chemicals, transport, energy etc. is to adopt the approach in Figure 2.1 at the scheme level. To support this, a modular development of criteria documents should be considered. Such a system may be database-based to ensure that no earlier experience with a specific substance will be forgotten when developing or revising a criteria document. In such a system, when introducing a substance for criteria setting, a list of all earlier criteria in all criteria documents related to this substance would be available, and thereby, a level suggested. Then the criterion on the substance for the specific application may be suggested with full knowledge of the history of the scheme. In this regard, it can be mentioned that this concept has already been implemented in the Nordic Environmental label criteria for paper.

On the output side, such a system would provide much clearer messages, such as “the level of lead in an eco-labelled product will not exceed 100 ppm”.

### 2.7.5 Relation to other environmental policies and actions

Another discussion, which is related to the one above, is about the possibilities of integrating eco-labelling with other LCA based tools. Many of the tools under the Integrated Product Policy [COM (2003) 302] (IPP) have in common that the life cycle approach is the basis, and therefore life cycle data on products are necessary for the operation of the tool. Examples are eco-labelling (type I and III), eco-design, green product development and green procurement. But also, tools that are traditionally not regarded as belonging to the IPP family may benefit from a life cycle approach and supporting data. Striking examples are environmental management systems (EMAS and ISO 14001), environmental reporting and cleaner technology measures, like the activities under the IPPC Directive (1996/61).

For example, EMAS registered companies will have to confront the challenge of prioritising the actions that will continuously lower the environmental impact from their production. In the beginning, this will normally be an easy task, because there is a great deal of knowledge about environmental hot spots in the production. But after some years of continuous improvement, then the use of energy, water, chemicals, etc. has been optimised, and the task of prioritisation becomes more difficult. At this stage, the introduction of a life cycle approach may often lead to new knowledge and thus, initiate new actions that may lower the environmental impact further. For this purpose, the companies will need life cycle data, i.e. data related to the product – not the production site, and data from stakeholders around the production site in the product chain.

Once this approach has been implemented and data has been gathered, the basis has been established for a number of IPP tools, which may be integrated on various levels in the company and used by a number of stakeholders around the company: An eco-label license may be obtained, environmental product declarations may be developed and used in marketing, documentation on environmental impacts from products will be available for customers, authorities, neighbours, and other stakeholders – and may be used for greener purchasing. However, one pre-requirement for developing an environmental product declaration for graphics products is the completion of a projects with the purpose of generating uniform methods for collecting data. Internally this approach will provide a unique overview of the product – not only technically on site, but also regarding materials, resources, waste, chemicals etc. which come as input to and output from the site. And the effort of stepping from the life cycle approach and data basis to the other IPP tools may be limited because they all draw on the same basis and data sets. However, today each company has to *invent the wheel* themselves regarding how to optimise the work across all obligations, but if the schemes developed further integration, then the companies might, for example, report data only once, generating both an environmental product declaration (EPD), giving an EU Flower licence and reporting on best available technology for a line of products.

If these aspects are taken seriously by those who develop and run schemes for labelling and stakeholders around them, then methods and procedures should be developed for integrating instruments a lot more than they are today. The

struggle SMEs in particular have in living up to all kinds of obligations to record and report on environmental issues is a strong incentive for the development of an integrated approach to all this.

If eco-label criteria documents were developed in close mutual coordination with developments in other schemes and policies as mentioned above, then the struggle for the licence applicants may be easier. If also criteria on specific issues, like processes, materials and chemicals, could be harmonised, using a modular system, then criteria would be more easily accepted (because they have been used before), more easily understood and more easily communicated. Thereby, also the scheme will be more easily promoted and justified.

Figure 2.2 indicates how some of the IPP tools and other tools may be integrated if a more holistic approach is developed within European environmental policy. The core idea in the Figure is that within a framework platform, life cycle data on specific product families may be collected and agreed on. Based on this framework of data, companies may adjust to their own case with specific data and so have instant access to a number of tools: Firstly an EPD, and if this EPD based on the company specific data shows results below certain levels for each of the impact categories, then the Flower licence would automatically be assigned to the product.

Furthermore, if the company holds an EMAS registration, then the prioritisation would be much easier when the framework of data for the product area is established, because the LCA would point out the hot spots. If the EMAS Scheme is developed with the framework in mind, then it may be designed to give EMAS certified companies an obligation to cover those product group parameters that are defined in the framework. Thus the EMAS based environmental strategy will be further focussed and benchmarking between companies would be well defined.

Environmental reporting as part of a management system or as mandatory in some regions (e.g. green accounting in Denmark) would gain from an integrated framework, because data might be drawn more or less directly from generic life cycle data combined with site specific data.

Drawing the lines for the IPPC Scheme would be mainly on the data side, where the IPP framework and the IPPC Scheme would gain from mutual exchange of data on processes and technology between the BAT (Best Available Technology) Reference Notes (BREF) and life cycle inventory databases, which would ensure that both sides are always updated with latest information, and that data will be available on both the process and production site level as well as on the product level.

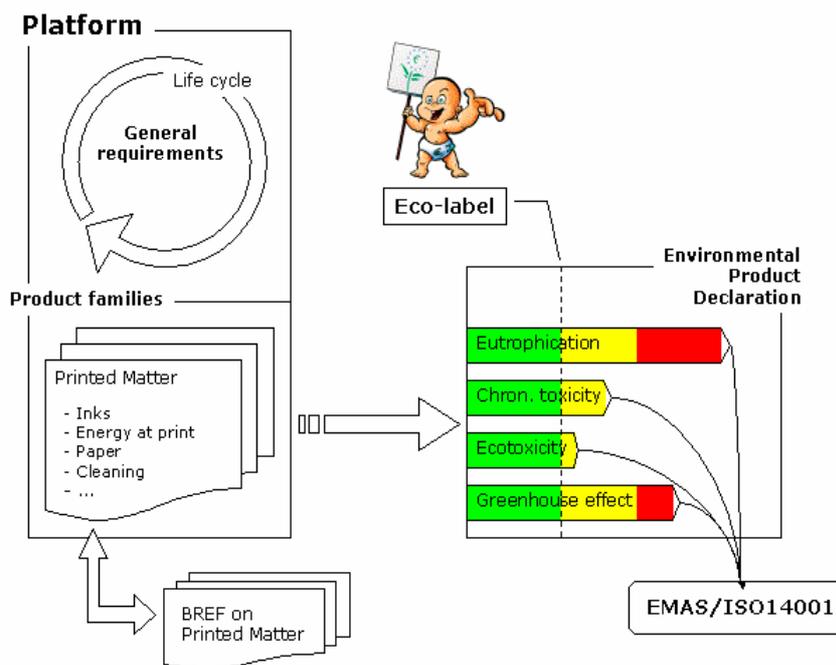


Figure 2.2 – Outline of a more integrated set of tools in European environmental policy. Here exemplified by the product family of Printed Matter. See further explanation in the text.

The framework platform as outlined here is not around the corner, but it reflects some of the ideas that are behind much strategy work on IPP and other environmental policies, and there is a large potential in streamlining the environmental obligations for companies all over Europe.

Today, incentives are low, because no legislation prescribes the life cycle approach. However, there is a proposal for a directive soon that prescribes documentation on eco-design considerations for energy using equipment (COM (2003) 453), which is the first case of such prescription. It can be expected that this is just the first product area which will be regulated in that way, and therefore a more general shift towards product life cycle based regulative drivers may be expected over the next decade and on.

Coming back to chemicals, the framework outlined may also be coupled to chemicals policy and schemes in future, which may again streamline the obligations for companies to report, for example on the use and discharge of chemical substances.

## 2.8 Conclusions on issues in future criteria documents

The comparison of the existing Swan Label Criteria Document for printed matter and the results of the Part II LCA study and existing LCA studies reveal a different distribution in the potential environmental impact between sub-processes and issues than presently reflected in the criteria document. The main reason for this is the result of the Part II study including data on production and emissions of chemicals, and chemical related impact categories to a degree not done before, thus making this LCA on printed matter more comprehensive. Furthermore the inclusion of knowledge about generic

composition of raw materials for the printing industry combined with knowledge about the potential environmental impact of the components has created the basis for the inclusion of the chemical related impact categories (ecotoxicity and human toxicity).

Many requirements are set, both on the point system level and as absolute requirements for chemicals, but the criteria are not consistent across the document, giving room for environmental properties of chemicals for one sub-process that are restricted for use in other sub-processes. The inconsistent structure of the criteria document creates confusion about which chemicals are allowed and which is not. Thus, a more stringent structure related to substances covered would improve the feasibility of a future criteria document. See Figure 2.1 above on a proposed alternative structure.

A number of further studies are needed to assess and further conclude how to set criteria on chemicals, as this field is new and dominated by lack of data and consensus on methodology.

There is the general discussion about how to set requirements to substances. The following five methods are commonly used in eco-labelling:

- classification based requirements
- negative lists
- positive list
- max. content level requirements
- documentation requirements
- combinations of these

Each method has its pros and cons, and it may be considered – especially if the approach given in Figure 2.1 is adopted – more strategically how and when the different methods should be applied.

Further studies to strengthen the development of criteria that provide the best environmental improvement profile would be:

- a study to identify if criteria should focus on the choice of ink types or ingredients or on cleaner technologies and emission control
- a study to further identify impacts from upstream emissions (e.g. production of pigments)
- a study of the possibilities for optimisation of energy consumption in the relevant processes
- a study on the relevance and steerability of transport processes for printed matter
- a study at sector level on the possibility of changing the functional unit from weight of product to, for example, the area printed product. It is worthy of note that a case study was carried out in Denmark for a single company based on processes and key process figures for only this company in this area.

It may be a good idea to create simple LCA databases for each product group or printing technique (e.g. sheet fed offset, cold set, heat set, screen printing etc.), making it possible to identify the consequences of substitution, consumption reduction etc. during criteria development. The development of these databases could benefit from the experience and the unit processes on sheet fed offset already achieved in the Part II study.

# 3 Comparison with priorities in the Paper Profile Manual

An environmental product declaration concept has been agreed upon between a number of Nordic paper producing companies. The concept is described on [www.paperprofile.com](http://www.paperprofile.com). The concept is not a full ISO 14020, type III eco-labelling system, as there is no third party control defined – only recommended informally<sup>1</sup>. The declaration is rather a marketing format, creating a uniform platform for communication of environmental parameters (ISO 14020: a self-declaration, type II claim, where the producer holds the full responsibility for the quality and correctness of the declaration and supporting documentation, according to general marketing law). To eco-labelling experts, this is evident from the Manual, because there is no reference in the Paper Profile Manual to the ISO 14020 or ISO TR 14025, but for the average user, this is not clear, because the term “declaration” is used widely.

In the following, the environmental parameters covered by the Paper Profile, are compared to the results of the LCA study described in Part II of this report.

## 3.1 Parameters included in the Paper Profile

All parameters included in the Paper Profile Manual are based on a functional unit of one tonne of paper product. Parameters are divided into four categories: emissions from production to water, air, deposits, and energy consumption. Thus, excluding timber production (forestry) and the use and disposal phases, there is no attempt in the Paper Profile concept to cover the entire life cycle of paper products. The concept is rather a pulp and paper production sites benchmarking system. The parameters are:

Emissions to water:

- COD (kg/t)
- AOX (kg/t)
- N<sub>total</sub> (kg/t)
- P<sub>total</sub> (kg/t)

Emissions to air:

- SO<sub>2</sub> (kg/t)
- NO<sub>x</sub> (kg/t)
- CO<sub>2</sub> (fossil) (kg/t)

Deposits:

- Solid waste land-filled (kg dry matter/t)

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It is stated in the introductory text to the Paper Profile Manual that: “In order to verify that a declaration complies with the Paper Profile environmental product declaration format and with this manual, accredited verification of the declaration by a certification body is highly recommended.”

Energy consumption:

- Purchased electricity consumption (kWh/t)

Apart from the listed environmental parameters, the Paper Profile Manual gives space for:

- Registration of certified environmental management systems, such as EMAS or ISO 14001
- Registration of wood fibres origin and environmental management on this level, including certified forests

### 3.2 Comparison to findings in Part II and other LCA studies

All LCA based studies referred to in this project conclude that paper production (cradle to gate) is one of the most significant contributors to potential environmental impact in the life cycle of printed matter, the main cause being related to energy consumption. This issue is covered in the Paper Profile Manual with one parameter, which covers “purchased electricity consumption”, which is defined as kWh tapped from the grid. If an integrated power production is part of the mill, emissions from that must be included in the emission inventory, but it will then only give rise to registration of CO<sub>2</sub> emissions from it – not all other aspects derived from energy consumption.

The Part II LCA study gives, as the first study ever, a much more detailed view of chemicals in the various life cycle stages of printed matter. One result of this focus is that paper production no longer dominates exclusively. The study reveals high impacts on eco-toxicity and persistent toxicity, and relatively less on the energy related impacts from paper production. Based on these findings, one could draw parallels to paper production and ask if a similar change from energy dominance to chemicals might appear if a more complete picture of the use of chemicals in paper production was drawn. To investigate this is, however, outside the scope of this study.

### 3.3 Comparison to the Swan criteria for printing paper

Compared to the emission parameters covered in the Swan criteria for printing paper (version 2.5), a fairly good accordance is observed. The four water emission parameters and the three air emission parameters of the Paper Profile are all included in the Swan criteria. However, the Swan criteria requires a full chemical declaration, and focuses further on some problematic chemicals that are not mentioned in the Paper Profile Manual at all: alkylphenol derivatives, residual monomers and acrylamide, surface-active agents and foam inhibitors of low biodegradability, chlorine gas for bleaching, EDTA/DTPA and biocides.

For the energy issue, the Swan criteria also limit the scope to the narrow pulp and paper production. However the Swan does not only cover electricity bought from the grid, but also includes own energy production and the procurement of fuels and residual products used for energy production.

Waste is in the Swan criteria handled at the sorting level, setting up only general requirements for fractions to be “recycled or processed in an appropriate manner”. The Paper Profile Manual covers one waste stream, “solid waste land-filled”, by recording the dry weight deposited.

### 3.4 Methodological Discussion

As the parameters given in the Paper Profile Manual do not cover a life cycle perspective for paper products, the scheme cannot be seen as more than a type II self claim. Self-claims do normally cover only one or few parameters, for example, the fraction of recycled raw material or the absence of lead in the product. By setting up a self-claim programme, which apparently covers the life cycle, users may be caught in the misunderstanding that by following the Manual, a full EPD, covering the life cycle of paper is documented. This is not the case, and users may encounter problems with marketing law if they claim in general terms that their product is environmentally friendly, based on the declaration only.

The scope for energy consumption in pulp and paper production is subject to discussion, due to different viewpoints on timber as a resource for paper versus energy production. This issue has great influence on the environmental impact of paper products, especially chemical pulp based paper produced in non-integrated pulp and paper productions, and is therefore important to the results in a declaration. According to the Paper Profile Manual, only electricity bought from the grid should be included, but much energy for pulp processing comes from burning excess timber, which is then not included on the resource pull, but included regarding the emissions of  $\text{NO}_x$  and  $\text{SO}_2$ .

Type II claims are justified as the simple, informal way of communicating environmental information on products to costumers. A type II claim is normally not life cycle based, but on the other hand, it may be based on life cycle data, if available. Therefore, a claim system like the one defined in the Paper Profile Manual would provide a better solution if integrated with type I and type III labelling, as defined in ISO14020. In such a case, a full LCA on a paper product will then form the basis of both an eco-labelling type I licence, and EPD and selected type II claims ad hoc.

EPD product specific requirements (PSR) are under development in the Nordic Tissue Association for tissue paper products, established and expired for sawn timber under the Swedish EPD Scheme and present for two kinds of packaging under the Japanese Scheme and one kind of tissue product under the Korean Scheme. PSR may also be expected under the emerging Danish Scheme 2004-06. Swan type I criteria have been available for printing paper since 1996.

Therefore, much of the framework for an integrated system is already available, and drivers for product oriented environmental policies are emerging over the next decade. Thus, we can expect efforts from many stakeholders to bring different approaches and tools together aiming at a future integrated system approach, which may embrace both eco-labelling type I-III and management systems with input from IPPC activities, synergies with greener procurement actions etc



# 4 Synergy effects and supplier collaboration

This chapter is defined within the following frameworks of goals, activities and results:

## *Goals*

To present examples of synergy effects achieved through introducing environmental labels in environmental management systems.

## *Activities*

On the basis of the experience gathered in the graphics sector in Denmark with the Swan Nordic environmental label, as well as environmental management in relation to ISO 14001 and EMAS, the synergy effects generated by combining environmental labelling and environmental management are described.

Using GA's guide to environmental management as the background, which is currently used by nearly 50 printing companies, examples of the use of the environmental requirements for environmental labels implemented into environmental management systems have been examined and evaluation with the aim of revealing synergy effects which could be generated between them.

Examples of the use of the Swan at both the strategic and operational level in environmental management have been drawn up. Also, examples have been drawn up of the supportive effect of environmental labels in developing both an environmental policy and the operational system.

## *Results*

Examples of the synergy and supportive effect that can be achieved by producing methods for integrating the environmental label criteria into the environmental management system.

Proposals for producing methods for product-oriented environmental management with a view to developing or revising the environmental label criteria in the environmental management systems for the Swan and the Flower.

## *The structure of the sections*

The system used is first to describe the Danish experience with environmental management and environmental labelling. This is followed by a number of interactive effects (in the description of results these are called synergy and supportive effects), which are typically achieved by companies that work with both environmental labelling and environmental management systems. Finally the relationship is made concrete by setting out some actual suggestions for making environmental management systems product-oriented.

## 4.1 Environmental management in printing companies

In Denmark in 2004 there are over 50 graphics companies, which have an ISO 14001 certificate and/or an EMAS registration. The principal types of company that are certified work with sheet offset and heat set printing. They mainly produce advertising material, brochures, magazines, books etc. Companies, which are certified and/or registered, represent around 50% of the production capacity in Denmark in the groups mentioned.

The first Danish graphics company was certified in the mid-1990s. By the end of the millennium, that number had risen to more than 50. It was particularly the customers for printed matter, and their increased focus on the environment, who put environmental certification on the agenda at the graphics companies, and still today it is often a requirement that the company be environmentally certified in order to qualify to bid for large scale public sector printed material commissions.

The next sections are based on the elements which Danish graphics companies work seriously with in regard to environmental management. They can be categorised as:

- Determining significant impacts
- Environmental management of the company
- Auditing

### 4.1.1 Significant impacts

One precondition for developing environmental management is that the company is able to identify and focus on the significant environmental impacts generated by its production, the raw materials used and the way in which the products are used and disposed of.

The ISO 14001 standard defines this as follows, "The organisation shall establish and maintain (a) procedure(s) to identify the environmental aspects of its activities, products or services that it can control and over which it can be expected to have an influence, in order to determine those which have significant impact on the environment".

In practice it is usual, as far as Danish graphics companies are concerned, to identify the significant environmental impacts on the basis of criteria such as the volume of environmental parameters, hazard, legislative requirements, occupational health and safety and/or economic considerations etc.

Some companies have approached their environmental work by identifying and prioritising the significant environmental parameters by using various theories formulated in relatively comprehensive point-scoring models. The results of using these various points models has been shown by experience to be identical to the results achieved by letting the companies use what is in practice a model more accessible to the company, where the significant environmental parameters for production are evaluated on the basis of volume, danger, legislative requirements, occupational health and safety and/or economic considerations etc.

In fact today nearly all the graphics companies use the procedure described above when it is necessary to identify environmental parameters for setting goals, action plans and management. In addition, those companies who are licensed to use the Swan label for printed matter have the chance to include

the criteria from this scheme when identifying significant environmental conditions.

Annex B gives an example of a typical matrix of significant types of impacts for a sheet fed printing company. The term “significant impacts” is defined in the ISO 14001 standard.

#### 4.1.2 Environmental management of the company

Annex C shows an overview of the elements Danish graphics companies typically focus on in their environmental management systems.

The central fulcrum of the company’s environmental work is formulated in the environmental policy, goals and action plans collectively called the environmental strategy. In fact for many years Danish graphics companies have had a tradition of setting up action plans for reducing the use of VOCs, paper, inks etc. as well as minimising waste and the discharge of wastewater.

In addition, the environmental management systems often place a special focus on:

- Evaluating raw materials, including chemicals and other additives
- Evaluating the production equipment
- Consumption of raw materials
- Advising customers
- Pre-sorting waste

##### *Evaluating raw materials, including chemicals and other additives*

A number of different chemicals are used in producing printed matter, of which the most important are ink, varnish, glue, damping solution concentrates, alcohol and washing agents as well as photographic chemicals. Typically, the selection of these products has been assessed on the basis of parameters such as price, quality and delivery reliability. In recent years, as mentioned, greater weight has been placed on factors such as the environment and occupational health and safety.

In general in Europe there is a very wide selection of raw materials and products for graphic production. There are many different variants of each of these raw materials and products.

In general, graphics companies often change products. The reason for this stems from several factors. Part of the reason is just the large selection of raw materials and products available; another reason is the continuous technological development in these areas. Another factor has been that as a natural consequence of price pressure in the market for printed matter, there has been pressure on suppliers’ product prices.

As graphics companies choose products in a market where there are a large number of products, and where it is very difficult to form a complete view, it has proved very difficult to place much focus in the environmental management systems on environmental assessment of new chemicals and additives in such a way as to avoid the introduction of new products with worse environmental qualities than those previously used.

##### *Evaluating the production equipment*

There has been a great deal of technological development in the graphics sector over many years. The digitalisation of the production equipment and the

development of machines with ever-higher production volumes have played a key role. Technological development in general, alongside the keen competition in the market for printed matter has meant, and still means, that companies must develop and consolidate their market position, and this has required a relatively extensive replacement of production equipment.

Replacing production equipment often involves changes in the significant environmental impacts generated by the companies. If this concerns production equipment, which, despite the speed of technological development, has a relatively long lifetime, there will be many significant consequences for the overall environmental impact of the companies for many years to come.

Thus it is important to evaluate new production equipment not just technically and financially, but also from an environmental point of view. Thus, as a main rule, environmental management systems in the Danish graphics companies include guidelines for evaluating production equipment.

#### *Consumption of raw materials*

Not using resources optimally normally leads to unnecessary environmental impacts.

By monitoring the consumption of raw materials and the disposal of waste, the company has an opportunity to make a management initiative concerning unnecessary environmental impacts. In the environmental management system this monitoring is typically performed through agreed procedures for recording non-conformances, and preventive and corrective actions, or through systems, which register waste continuously.

Procedures for non-conformances and corrective actions and preventive are an important aspect of a management system. Insofar as this part of the environmental management system is implemented successfully, the company has the opportunity to involve all levels of employee in identifying variations in consumption of raw materials or waste. Also, and absolutely central to the dynamics of the system, continuous registration of non-conformances will produce knowledge about new environmental goals and areas of initiative.

Using systems for continuous registration of waste ensures continuous monitoring, which makes it possible not only to take action if there is suddenly a large unnecessary wastage of raw materials, but also to assess the usage of raw materials etc. from a strategic perspective, both from an economic and environmental point of view.

#### *Advising customers*

As can be seen from the LCA conducted in Part II of the project, the customer's choice of design, gram weight, format etc. has a large influence on the overall environmental impact of the graphics product.

Products (raw materials) such as paper and inks play a not insignificant role, and therefore it makes a big difference not just that the printing company itself can use paper and inks as optimally as possible, but also that there are discussions with customers about design and format with the aim of avoiding, for example, an unnecessarily large waste of paper during production. For example, choosing the lowest gram weight possible for the material will have a positive effect on environmental impacts.

Advising customers about environmental aspects when designing printed matter is also an important environmental parameter, and so should be included in both the strategic and operational parts of the environmental management system. In fact, by far the majority of companies who work with environmental management focus on this in selling and marketing printed matter, and this is reflected in their environmental policies, sales procedures, external information etc.

#### *Pre-sorting waste*

In Denmark, waste has to be sorted at source by law, and each municipality has special regulations for sorting commercial waste. When disposing of waste it is attempted to give the highest priority to truly recycling it, and as a second priority that waste that cannot really be reused is destroyed by incineration at plants, which use the energy, released for electricity generation or district heating. Waste, which can be neither recycled nor incinerated, is destroyed or dumped as landfill at specially designed areas.

This legislation is reflected in the environmental management systems at the companies, where there is a great deal of pre-sorting, so as much as possible can be recycled and the rest incinerated or dumped. In practice there are concrete guidelines for sorting and disposal, which are generally included in the instructions for individual departments or processes.

#### **4.1.3 Environmental management system audit**

To ensure that results are achieved and the management system develops, there are periodic reviews, both internally and using external audits of the environmental management system. For the most part, Danish graphics companies place particular weight on the relevance of the goals and action plans established, as well as the ability of the company to carry them out, the site view, environmental awareness, use of assessments of chemicals and production equipment and the ability to conform to the appropriate legislation.

#### **4.2 Environmental labelling of graphic products**

In Denmark, over 130 graphics companies have a licence to label printed matter with the Nordic Swan. Most of those who have this licence are sheet offset and heat offset printing companies who produce advertising material, brochures, magazines, books etc. The companies represent between 80 and 90 per cent of the production capacity in Denmark in these areas.

The first company was awarded a licence at the end of the 1990s, and when the previous criteria document was issued in 2002, there were more than 160 license holders. The reason that the number has fallen to approximately 130 today is the general reduction in the number of companies in Denmark, due to mergers, acquisitions etc. Thus this should not be taken to mean that the companies who are licensed today have a lower production capacity than the total of companies licensed in the past.

The following section will describe the key elements in the work involved with environmental labelling. These in turn will be sub-divided into:

- criteria
- maintaining the licence and the production of Swan labelled products
- inspection

#### 4.2.1 Criteria

When a manufacturer or dealer applies for a licence to produce environmentally labelled products, the general purpose with the various environmental schemes is to provide a guarantee that the product is amongst the best from an environmental point of view. The label conveys the right to market the product as more environmentally friendly than other products of similar type, which do not carry an environmental label.

The requirements for the Swan and the EU Flower attempt to employ the cradle-to-grave principle. The mapping normally involves five phases: Raw materials used, production, distribution and packaging, use and disposal.

However, the results of Part II of this project show that the existing requirements in the criteria document for Swan labelling of printed matter are only supported to a lesser degree by knowledge gleaned from recognised life cycle analyses.

The goal for establishing the level of requirements in both the Nordic and European environmental label is that no more than one third of goods on the market will be able to fulfil the criteria when they come into force. This is set out as goal, but for this study it has not been possible to obtain information, which gives more details about it.

Annex D lists the parameters required to be allowed to use the Swan label. There is also an assessment of what environmental impacts these parameters have had and the extent to which it is actually possible to monitor and control the individual requirements.

#### 4.2.2 Maintaining the licence and the production of Swan labelled products.

A company with a Swan label licence for printed matter must continuously maintain that licence. Should the company change:

- inks, varnishes, glues, washing agents, damping solution concentrates etc.
- sub-contractors
- consumption volumes (washing agents and alcohol)
- production equipment

the licence awarder must be informed.

Similarly, in order to keep its licence, the company must ensure that a number of concrete conditions are met for the production of the particular product to be Swan labelled.

#### 4.2.3 Inspection

The company is controlled by the environmental scheme on the award of the licence and/or an inspection visit during the period for which the licence is valid.

The main items inspected are:

- use of the logo
- compliance with the licence for production of Swan labelled orders

- conformity between the statements in the application (use of chemicals, sub-contractors etc) and reality

### 4.3 Synergy effects

On the basis of experience in Denmark, the next section presents a number of selected examples of the effects of incorporating environmental labelling into environmental management systems in the following areas:

- Environmental strategy
- Environmental aspects, significant impacts and areas of initiative
- Evaluation of raw materials - waste
- Evaluating the production equipment
- Consumption of raw materials
- Advising customers
- Audit/inspection

#### 4.3.1 Environmental strategy

##### *4.3.1.1 Incorporating environmental labelling in the environmental management system*

In the second half of the 1990s the Danish Environmental Protection Agency assessed the experience and results of ISO 14001 and EMAS in Denmark. One of the principal conclusions was that environmental management systems should be much more product-oriented than they had been until then.

Up until that point, the graphics companies had primarily focussed on the internal conditions of production at the companies, with the focus on reducing the use of water, electricity, consumption of solvents etc.

A number of graphics companies, however, right from the establishment of their environmental management system had decided, as part of their environmental strategy to provide information about the life cycle of the product itself. In practice this proved to be difficult for a number of reasons. Firstly, the operational part of the environmental management system was typically based on the actual production conditions within the company, but also, and perhaps most importantly, the sector as a whole lacked an overall analysis of the environmental relations of graphic products from a life cycle perspective.

For companies in general, the key goal will always be to produce products of the quality the market demands. Traditionally for graphics companies, this has meant visible qualities such as price, delivery, flexibility, advice and properties such as function, durability, design and the message in general.

The environmental properties added to a graphic product in the production process are different from these, because they are invisible. They are qualities that need to be made visible actively through providing information, and which are not immediately obvious from the appearance of the printed matter.

Seen in the light of the fact that the companies were lacking precise product-oriented knowledge about environmental conditions from an LCA perspective, as well as any methodological experience and training in environmental matters, then the introduction of the Swan environmental label by the Nordic Council of Ministers rapidly turned into a huge success in the graphics sector. The Swan logo became a tool, which could communicate simply, visibly and reliably with the customer partly about the product, partly about environ-

mental relationships and also provide the customers with a marketing impact in their own market.

While an environmental management system such as ISO 14001 and an eco-label such as the Swan are in theory two completely different systems, in a market-oriented context a decisive factor will often be what the customer markets best. The Swan label thus became both a tool for individual companies to make visible their ability to produce graphics products with consideration for the environment, while also involving the product-oriented element in the environmental management systems to a much higher degree than before, as well as a tool allowing the end-customers to market their own environmental awareness.

#### *4.3.1.2 Environmental management as an element in environmental labelling.*

The opportunity to be awarded a licence for environmental labelling meant that development at the companies, which wished to establish environmental management systems largely stopped. By far the majority of the companies, which already had an environmental management system, were awarded a licence for environmental labelling, but also a large number of companies, which did not have such systems in place, applied for and were awarded the licence.

Amongst the companies, which did not already have any environmental management system, there had previously been no tradition for working with environmental matters, and thus the Swan meant that the environmental parameters became part of the overall management strategy in a number of these companies. For these companies the idea of having to commit to environmental conditions in a technical production context was something new, and for this reason in many cases they had to start a process of change or invest in new technology to be able to meet the environmental requirements. These activities in turn meant for many companies that they have developed and implemented a type of environmental management system suitable for smaller companies in order to manage the ability of the company to introduce such activities and meet the requirements of the environmental label. In addition several companies have drawn up a real environmental strategy both for their own obligations and for external marketing.

### **4.3.2 Environmental aspects, significant impacts and areas of initiative.**

#### *4.3.2.1 Incorporating environmental labelling in the environmental management system*

As already mentioned, in principle, environmental management and environmental labelling are two different systems. Experience has shown, however, that it is neither possible nor particularly appropriate to separate these systems within the same company, as there are a number of circumstances in the systems which either complement or work against each other and thus need to be clarified.

For some companies environmental management has been used as an “answer book” in identifying significant environmental aspects, for others, using this “answer book” has shifted the focus from the significant environmental aspects the company has itself identified. For the first type of company with environmental management, there have been a number of areas with the result that there is a definite incongruity between:

- The significant environmental aspects identified on the basis of selected principles in the environmental management system and the environmental requirements which should be observed in the criteria document for the Swan label
- and
- The requirement for technology specified in the criteria document and that considered by the public authorities as the cleanest technology, especially at a regional level.

Both areas could be clarified by performing a life cycle analysis of the given product area.

Despite the lack of clarity, the requirements from environmental criteria could give the companies new opportunities to set goals, action plans and to follow up on them.

#### *4.3.2.2 Environmental management as an element in environmental labelling*

Companies, which had no experience of environmental management before being awarded a Swan label licence for printed matter, have in some cases used the environmental principles to set up action plans for meeting and maintaining the criteria. In this way companies have set activities in motion, which they would probably not otherwise have done without the licence. The criteria for the Swan have thus become a type of answer book for what good environmental practice is.

### **4.3.3 Evaluation of raw materials (chemicals)**

#### *4.3.3.1 Incorporating environmental labelling in the environmental management system*

The criteria for Swan labelling of printed matter include special requirements for the ingredients in and product qualities of inks, varnishes, glues, damping solution additives, washing agents and other products.

In practice, these products are approved through the manufacturer sending the necessary material for a particular product to the secretariat of the environmental labelling scheme. The environmental labelling scheme secretariat examine the documentation submitted and inform the manufacturer involved whether or not the product can be used for Swan labelled printed matter.

Printing companies that then want to use a specific product in their production of Swan labelled printed matter must they inquire from the scheme as to whether a particular product is approved.

This centralised collation of evaluations of product information provides companies, through the requirements of the Swan label, easy and reliable access to information for use in setting goals and action plans.

In this way the database for the environmental labelling scheme is a type of positive list, so the companies do not themselves have to make sometimes-difficult decisions on the basis of supplier instructions and other documentation, as they can rely on the database.

It also gives the potential for companies using environmental management to use the environmental label criteria as evaluation parameters in purchasing and using new chemicals.

#### *4.3.3.2 Environmental management as an element in environmental labelling*

Companies with the Swan licence are obliged to continuously maintain the licence, for example, when they wish to use new inks, varnishes, glues etc. This requires that the companies systematically evaluate new products, not just the technical and financial aspects, as is usual, but also in regard to the requirements of the environmental label. In order to ensure that all products are evaluated, and the evaluations are technically correct and conducted within a suitable timeframe, the companies have to draw up procedures.

### **4.3.4 Evaluating the production equipment**

#### *4.3.4.1 Incorporating environmental labelling in the environmental management system*

When investing in new production equipment, it is also essential to evaluate the investment in relation to the requirements for environmental labelling to ensure that these are still observed. In other words, companies have to commit to a number of specifications of an environmental nature relating to the actual investment in question.

In some cases, meeting the Swan label criteria can mean that the companies have to invest in special production equipment or ancillary equipment. Experience shows that companies which use environmental management already have procedures for environmental assessment of new production equipment implemented in these systems.

#### *4.3.4.2 Environmental management as an element in environmental labelling*

Licensed companies are obliged to maintain the licence on a continuous basis, for example, when they change production methods or equipment.

This requires that they systematically evaluate new production equipment, not just from a technical and financial point of view, but also from an environmental perspective. To ensure that the evaluation is technically correct, the company must have a procedure in place for evaluating new production equipment, including the environmental aspects.

### **4.3.5 Utilisation of raw materials - waste**

#### *4.3.5.1 Incorporating environmental labelling in the environmental management system*

Depending entirely on what requirements are set out in the environmental label criteria concerning the utilisation of raw materials, there will be elements that can advantageously be implemented in environmental management systems. Experience shows that many companies, which traditionally work with environmental management, have already established procedures for monitoring and managing raw materials consumption and volumes of waste.

#### *4.3.5.2 Environmental management as an element in environmental labelling*

In order to monitor the consumption of raw materials in relation to concrete environmental labelling requirements, it is important to introduce a certain level of environmental management.

As an example, the Swan criteria include requirements for the volumes of consumption of alcohol and washing agents. To monitor and follow up on such consumption, it is necessary to continuously register the volumes used, evaluate the consumption in regard to the environmental label requirements and, where necessary, set up action plans if the results are unsatisfactory.

#### 4.3.6 Advising customers

##### *4.3.6.1 Incorporating environmental labelling in the environmental management system*

As section 4.3.1.1 shows, the product-oriented element, that is environmental labelling, can be advantageously incorporated in environmental management systems in a number of areas.

As the LCA analyses in Part II show, there are a number of areas where it is impossible for a printing company alone to monitor the overall environmental impacts of a graphic product. The customers of the company are equally responsible for deciding on the design, choice of paper etc. for printed matter.

If the customer is offered an environmental label for a particular print product, there will normally be a potential to achieve a better environmental performance from an LCA perspective. It must be added that in the case of the Swan label criteria in particular there are shortcomings in relation to the significant environmental aspects identified in the LCA analyses in Part II. Thus there are no real requirements in the criteria document regarding parameters such as waste paper, gram weight etc.

##### *4.3.6.2 Environmental management as an element in environmental labelling*

Before customers can be correctly informed about the environmental label criteria, it is important that both existing and new sales personnel are given appropriate training. It is also important that any training that is done is consistent and accurate, so that it is an advantage for the company to have a procedure for this.

#### 4.3.7 Audit/inspection

##### *4.3.7.1 Incorporating environmental labelling in the environmental management system*

Many of the elements, which are continuously audited in environmental management systems, are identical to those, which have to be monitored to maintain environmental labelling requirements.

Some examples are as follows:

monitor and measure, on a regular basis, key characteristics of its operations  
establishing and maintaining procedures related to the identifiable significant environmental aspects of goods and communicating relevant procedures to suppliers

establishing and maintaining procedures for handling and investigating non-conformances

In this way, a good synergy effect can be achieved by auditing and monitoring the environmental managements system and the maintenance of the criteria for environmental labelling at the same time. This would give a more complete understanding of the whole and a better chance to see the conditions from a joint perspective.

Annex 4.1 shows an overview of monitoring elements, which the experience in Denmark has shown to be common to the Nordic Swan label and ISO 14001.

#### *4.3.7.2 Environmental management as an element in environmental labelling*

Any environmental requirement included in the environmental labelling criteria can, as described above, advantageously be monitored and audited along with the other parts of the environmental management system.

For companies that only work with environmental labelling, some of the monitoring they carry out for the label will be the same as those, which would come under an environmental management system.

### 4.4 A method for product-oriented environmental management

#### 4.4.1 Strategy/environmental conditions

To achieve a synergy by incorporating the requirements of environmental labelling in environmental management systems, it is important that the labelling criteria reflect the life cycle of the printed matter. These criteria, as explained in section 4.3.2.1, because the work with environmental labelling and environmental management cannot be separated within the same company, take the form of a BAT list, and so it is extremely important that the precise requirements in the environmental label criteria are well founded, and as a result of accepted LCA methods.

If this is not the case, then as environmental labelling becomes more widespread, the development will move in an inappropriate direction. Alternatively, it could happen that the graphics industry does not want to join in the scheme, because it wants to move in a different direction than that indicated and prioritised by the companies' own environmental management systems and what any LCA studies suggest.

An example is that the criteria for the Swan label set only a minimal focus on the use of paper and ink resources at the printing company. The LCA study in Part II shows that production of inks (pigments) and the manufacturing of paper form an important part of the overall life cycle of printed matter.

#### 4.4.2 Chemicals

##### *4.4.2.1 Visibility of areas of initiative*

As described in section 2.7.3, it is important that the environmental labelling criteria provide a good overview of the types of requirements for different kinds of chemicals, an example is shown in figure 4.1.

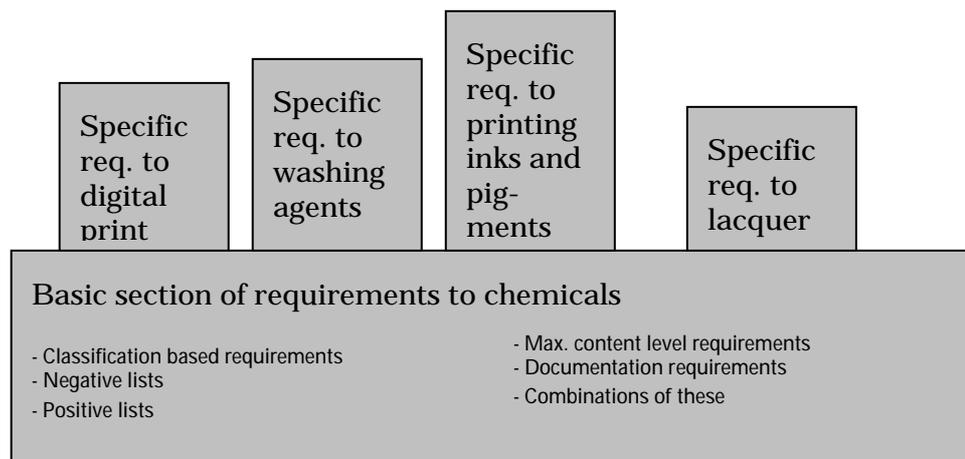


Figure 4.1 – Outline of an approach where requirements on chemicals are given as a base for other requirements.

This produces a transparency, which makes it easier for the printing companies to use the knowledge, which has been acquired about the relationship of environmental labelling and environmental management systems.

If the company generally wants to phase out the use of chemicals containing particular substances, not just for the production of Swan labelled matter, for example heavy metals, the environmental labelling criteria can be used to see what types of raw materials might contain such substances. The list of approved raw materials and chemicals can be used to find products for which the manufacturer has documented do not contain the substance in question.

#### 4.4.2.2 Procedure for evaluating chemicals

When setting the criteria for the Flower, as is currently the case for the Swan criteria document, tables should be produced which clearly state which requirements apply to a given type of product. These tables can be used for finding information about a given product and also used as checklist for the environmental management work of evaluating chemicals. The tables should be electronic and available from the web.

#### 4.4.3 Evaluating the production equipment

The ability of the company to meet the environmental label criteria will to some extent depend on what type of production equipment is used. In drawing up criteria for environmental labelling which reflect production of the graphic product from a life cycle perspective, the companies, when evaluating new production equipment from an environmental perspective want to be able to focus more directly on the actual investment from an essentially life cycle point of view.

Thus a synergy could be achieved by including environmental criteria in the procedures the company has in place for evaluating new production equipment.

This could result in the production of a positive list, which describes conditions or technology, which states where the environmental benefits of investment lie and also what priority should be accorded to the detailed environmental label criteria.

#### 4.4.4 Raw materials - waste

The LCA study in Part II shows that the production of some types of resources or raw materials, such as paper, inks or electricity contribute significantly to the overall environmental impact of printed matter. In addition several of the washing agents and alcohol currently in use also contribute significantly. Together, these five parameters account for over 90% of the total environmental impact of producing printed matter.

Requirements for these parameters can either be set as specific requirements on production of the raw materials and the contents of them, or on the company's ability to use the resources optimally. In some instances it will be important to set requirements for raw material production. It can therefore be important, at least initially, to set requirements for the company's ability to use resources, such as paper, inks, energy, washing agents and alcohol, optimally.

Of course the very best outcome would be that an environmental problem is eliminated as early in the life cycle as possible, but insofar as this is not possible, as mentioned, the simple fact that there is knowledge of the concrete conditions allow the companies to focus their environmental work on the most important elements in the process as a whole. Some examples of methods of controlling the consumption of the resources mentioned are given below:

Table 4.1 Consumption of resources

Parameter	Proposal for control
Paper	Reward for a focus on usage of paper in the form of continuous monitoring of unnecessary waste.
Inks	Registration of ink consumption and wastage. Requirements for volume of waste..
Energy	Reward to the extent that the company has conducted an energy mapping.  Reward to the extent that the company continuously monitors its energy consumption.
Alcohol	Reward for minimal volumes of added alcohol to damping solution.
Washing agents	Reward for using low volatility washing agents.

#### 4.4.5 Advising customers

An optimal synergy effect for companies in incorporating environmental labelling with their environmental management systems can be promoted by supporting graphics companies in disseminating general knowledge of the environmental label. This would create increased demand for environmentally labelled printed matter, and so the volume of printed matter produced accord-

ing to environmentally friendly principles would increase, and the environmental impact from the industry fall, everything else being equal.

#### **4.4.6 Audit/inspection**

As explained in section 4.3.7 the external certification body does audit many identical items for ISO 14001 and the external body that monitors companies' conformance with the environmental label criteria.

It would add considerable value to the environmental work of individual companies if the two systems could be audited in the same context. It would demonstrate whether the management procedures actually work in relation to the company's own monitoring and maintenance of the environmental label licence, and would also provide a greater confidence that the results of individual inspections are not simply co-incidental.



## 5 References

Axelsson, U., Dalhielm, R., Marcus, O. (1997). Miljöprofilering – livscykelanalyser av grafiske produkter, del 2. TEKNIKRAPPORT nr. 3/97. IMT.

Bagh, J., Pedersen, T., Skovlund, F. (2002). Environmental improvements by Ecolabelling - a case story from the field of printed matter ", Euro Environment, Paper, 2002-10-02.

Brodin, L. and Korostenski, J. (1995). Miljöbelastningar från grafisk industri i Sverige. Grafiska Miljögruppen. Report version 2 (15-04-1995). Report to SFS

Brodin, L. and Korostenski, J. (1997). Miljöbelastningar från grafisk industri i Sverige: Screen-, Flexo-, Digitaltryck och Efterbearbetning. Preliminär rapport. Kompletterad och reviderad version. Grafiska Miljögruppen. Report version 3 (18-06-1997). Report to SFS

Dalhielm, R., Axelsson, U. (1995). Miljöprofilering – livscykelanalyser av grafiske produkter. TEKNIKRAPPORT nr. 4/95. IMT.

Drivsholm, T., Maag, J., Christensen, S., V., Hansen, E. (1997). Miljøeffekter og ressourceforbrug for tre grafiske produkter i et livscyklusperspektiv. Miljøprojekt nr. 341. Miljø- og Energiministeriet. Miljøstyrelsen.

INFRAS (1998). LCA Graphic Paper and Print Products (Part 2: Report on the industrial processes assessment). An environmental project of: Axel Springer Verlag, STORA and CANFOR. Scientific consultant: INFRAS, Zürich

Nordic Ecolabelling. Ecolabelling of Printed Matter. Criteria document. 21 March 2001 – 14 March 2005. Version 3.1. Nordic Ecolabelling. (<http://www.svanen.nu/DocEng/041e.pdf>)

SFS (2001). Bakgrundsdokument till kriteriedokumentet för miljömärkning av Trycksaker. 2001-03-30. Reviderad i enlighet med fastlagd kriteriedokumentet (2001-03-21, version 3.0). SFS-Miljömärkning.

# Technical background documents and criteria document

In the descriptions below a short commented overview of the two technical background documents /1,2/ and the Swan criteria document /3/ is given.

## 5.1 Overview: Background document from April 1995

This overview covers a short description of the technical background document "Miljöbelastningar från grafisk industri i Sverige (15-04-1995)" /1/ used in the development of the Swan criteria document /3/.

- This report /1/ is the technical background report for the first criteria document (version 1.0) based on data from 98 Swedish printing companies i.e. 60 sheet fed offset (10% of bigger industries, i.e. 2->200 employees), web (cold set), heat set and gravure. Finishing is only based on data from 3 printing companies
- The use of an LCA approach is not mentioned
- The report primarily describes the status of consumption, emissions, key figures, techniques and regulatory demands as related to the industry
- The proposed criteria are mainly based on production related key figures combined with regulatory demands (water quality criteria ...)

Includes:

- Paper (ecolabel demand)
- Printing ink, glue, lacquer, solvents
- Emissions to air, water and waste

Excludes:

- Energy consumption

### (2.1) Page production (50 printing companies)

- Black/white film used
- 94% of the printing companies treat used film as chemical waste (reuse) (Table 2.1)
- Film as waste: 0.07 kg film/m<sup>2</sup> film (Table 2.1)
- Developer consumption 0.48 L/m<sup>2</sup> film (ready for use dilution) (Table 2.1). Contains hydroquinone
- Fixer consumption 0.43 L/m<sup>2</sup> film (ready for use dilution) (Table 2.1). Based on an acid thiosulphate solution
- 98% of the printing companies treat used developer and fixer as chemical waste (Table 2.1)
- Developer as waste: 0.46 L/m<sup>2</sup> film (Table 2.1)
- Developer as waste: 0.35 L/m<sup>2</sup> film (Table 2.1)
- Ag content of fixer typically below 3 g/l if treated by electrolysis: 0.5-1.0 g/l

- Carry-over of fixer to rinse water: 20-200 ml/m<sup>2</sup>
- Ag content of rinse water: < 0.05 mg/l (treatment) (0.1 mg/l according to Table 2.1) -> 15 mg/l (no treatment) (1 mg/l according to Table 2.1) corresponding to 13 mg/m<sup>2</sup> or 50 mg/m<sup>2</sup> depending on use of electrolysis or not
- Regulatory demands on rinse water to WWTP: 0.1 – 1 mg/l (0.25 mg/l in DK /4/)
- Algaecides used in rinse water (if as typically) recirculated: 1,2-benzisothiazol-3-one (trichloroisocyan acid, natriumhypochlorit)
- Cleaning of machine for developing (rollers, 4 times a year) may result in significant emission of Ag to sewer
- Proof printing: Developer account for 5-10% of total consumption. Developer typically based on tensides and alkaline salts (e.g. Matchprint-system contains nonylphenolethoxylate <1%)
- Proposal for criteria demand:
  - Emission of Ag to WWTP must be controlled each month (4)
  - Emission of Ag to WWTP < 15 mg/m<sup>2</sup> (<10 mg/m<sup>2</sup> in version 3.1) (4.1)
  - Developer and fixer must be treated as chemical waste (4.1)
  - Cleaning agents containing Cr must not be used (4.1)
  - No use of chemicals with > 1% content of environmental hazardous substances (according to Council Directive 67/548/ECC)
  - Surfactants in products used must be readily biodegradable (OECD 301)

(2.2.1) Printing form, i.e. plate-making (offset) (25 printing companies)

- Negative plates account for 90% of consumption in Sweden
- Used plates (waste for reuse): 0.9 kg/m<sup>2</sup> plate (Table 2.2.1)
- Consumption of developer in ready to use dilution: 0.2 L/m<sup>2</sup> plate (Table 2.2.1)
- Used developer is toxic (e.g. inhibits nitrification) and may contain metals such as Zn, Cu, Fe and Ni at a concentration above 1 mg/l
- Rinse water is toxic (e.g. inhibits nitrification)
- About 50% of the amount used developer is not collected today (ends up in sewer?) – only 35% of the printing companies collect and treat as chemical waste (Table 2.2.1)
- No plate developers better than use of water based developers
- CTP assessed the same way as dry offset (not rewarded)
- Silver based CTP plates allowed – requirements the same as for page production
- Proposal for criteria demand:
  - Developer must be treated as chemical waste (4.1)
  - No use of chemicals with > 1% content of environmental hazardous substances (according to Council Directive 67/548/ECC)
  - Surfactants in products used must be readily biodegradable (OECD 301)

(2.3) Printing (sheet fed offset) (60 printing companies)

- Paper waste: 96 kg/ton product (Table 2.3.1)
- Highest environmental problem is cleaning resulting in emissions of cleaning agents to air and water
- Consumption of printing inks: 5.8 kg/ton product (Table 2.3.1)
- Co and Mn in siccatives may account for around 1% in the printing ink
- Fungicides in vegetable based inks: isothiazolinone, benzisothiazolinone
- Softeners e.g. fatty acid esters in printing inks
- Plates is cleaned with e.g. citric acid and phosphorus acid
- Consumption of IPA for fountain solutions: 5 L/ton product (Table 2.3.1)
- When cleaning fountain system (e.g. once a week) used fountain solution containing ink residues and “paper dust” is emitted to sewer
- Analysis of used fountain solution for fat/carbonhydrides and COD shows 100 mg/l and 1000 mg/l respectively
- 80% of used IPA is emitted to air – the rest goes to sewer (some with the product)
- Consumption of solvents for cleaning equals 3 L/ton product (Table 2.3.1). Cleaning agents with high aromatic content, low aromatic content and aliphatic and vegetable based types are used for cleaning the printing machine.
- When cleaning “dampening form rollers with cloth” all cleaning agent etc. is emitted to sewer
- Waste (ink, cloth, solvents): 2.5 kg/ton product (Table 2.3.1)
- Proposal for criteria demand:
  - Swan labelled paper must be used (4)
  - No heavy metal based inks except for copper phthalocyanine blue (4)
  - Biocides in fountain solutions must max. account for 10 ppm (4)
  - Surfactants in products used must be readily biodegradable (OECD 301)

(2.4) Finishing (3 printing companies)

- LACQUERING:
- “Offset lacquer” (based on solvent and oil, i.e. sheet fed offset ink without pigment) is used in sheet fed offset (5-15% of total consumption)
- Water based lacquer (dispersion) is dominant i.e. 80% of total consumption; content: acrylic polymer dispersed in water, in some cases solvent is included (IR drying)
- UV lacquer 10-15% of total consumption (UV drying)
- Consumption of lacquer: 3.2-8 kg/ton product (Table 2.4)
- Cleaning is done only when changing lacquer. Typically with water and cloth. All wastewater goes to sewer. If solvent based, solvent (e.g. ethyl acetate and cloth) is used
- Proposal for criteria requirements:

- The used lacquer must not create problems in the re-use step of the paper (referring to Swan criteria for envelopes) (4)
  - UV lacquer residues and other lacquer residues containing solvents or other environmental hazardous substances must be treated as chemical waste
- LAMINATING:
  - Laminating with thin plastic film is typically done with water based adhesives and is done by a specialist company (outside printing firm)
  - Cleaning with water
- CUTTING:
  - Typically separate machine in sheet fed offset. Resulting in paper waste, see above
- STAPLING:
  - Used for e.g. leaflets. Small amounts of metal wire as waste
- GLUEING:
  - Hot adhesives, cold adhesives and PUR adhesives are typically used
  - Hot adhesives are typically used for catalogues and magazines. Content: Resin (vinylacetate/polyetene) wax, rosin, fillers and stabilisers
  - Cold adhesives are used for books (e.g. IR drying). Dispersion of polyvinyl acetate (particles) in water, benzothiazoloner (<0.1%), phthalates (e.g. dibutyl phthalate)
  - Cleaning of machinery after use of hot adhesives is typically done by warming up and using cloth. Cleaning after use of cold adhesives is done with water, which ends up in the sewer. "Very dry" adhesives may be removed by use of ethyl acetate or gasoline. The amount of waste water is relatively small
- Proposal for criteria requirements:
  - The used adhesive must not create problems in the re-use step of the paper (referring to Swan criteria for envelopes) (4)
  - Adhesive residues containing solvents or other environmental hazardous substances must be treated as chemical waste
- ADDRESSING:
  - Typically very small amounts of ink (ink jet) are used for marking the products
- PACKAGING:
  - "Typically wood pallet, paper or "shrink plastic"
- DISTRIBUTION:
  - distribution of products (books, magazines, leaflets etc.) from sheet fed offset is done by truck

(4) Proposal for general requirements for chemicals

- No use of chemicals with > 1% content of an environmental hazardous substance (according to Council Directive 67/548/ECC)
- No use of chlorinated solvents

(4) Proposal for general requirements for solvent emission to air

- Emission must be estimated by use of mass balances

(4) Proposal for general requirements for waste

- Sorting must be done
- Solvent waste including cloths must be treated as chemical waste (2.4)
- Paper waste must be collected and reused (2.4)
- Plastic waste (including waste from laminating) is collected and reused or incinerated (2.4)

## 5.2 Overview: Background document from June 1997

This overview covers a short description of the technical background document "Miljöbelastningar från grafisk industri i Sverige Screen-, Flexo-, Digitaltryck och Efterbehandling (18-06-1997)" /2/ used in the development of the Swan criteria document /3/.

- This report /2/ is the technical background report for the revision of the first criteria document (version 1.0). It is based on information ("official" environmental reports and separate questionnaires) from 67 Swedish printing companies i.e. 5 companies specialising in finishing and 15 printing companies using lacquering/gluing, and the rest are printing companies dealing with screen-, flexo-, or digital printing which is not included in this note. In order to make an assessment of the influence of different raw materials on the reuse of paper questionnaires to 8 paper and pulp companies, and 2 "sorting companies" are included
- The use of an LCA approach is not mentioned
- The criteria are mainly based on production related key figures combined with regulatory demands (water quality criteria ...)

Includes:

- Paper (ecolabel demand)
- Printing ink, glue, lacquer, solvents
- Emissions to air, water and waste

Excludes:

- Energy consumption

### (2.4) Finishing (20 companies)

- (2.4.1) LACQUERING:
- "Offset lacquer" resembles a sheet fed offset ink without pigment. Accounts for around 5% of all consumption of lacquer
- Water based lacquer (dispersion) is dominant i.e. 75% of total consumption; content: acrylic polymer, glycol's, glycol ethers, corrosion inhibitors, biocides, surfactants and amines. IR drying some cases
- UV lacquer accounts for around 15% of total consumption (UV drying). Content: Mono and pre-polymers of e.g. acrylates and photoinitiators (benzophenone) and inhibitors (hydroquinone, p-methoxy phenol)

- Solvent based lacquer and other types accounts for only around 5% of total consumption
- Offset: Water-based, “offset lacquer” and UV-lacquer is used. 1.5 – 8 g/m<sup>2</sup> is used depending on application technique. A separate printing plate is needed
- Cleaning is done only when changing lacquer. For partial lacquering in offset (on offset printing machine) 1-2 times a day. If “full tone” lacquering is used in offset (on offset printing machine) 1 time each week. Lacquering machine 1-2 each year. Water and solvent (e.g. ethyl acetate, isopropanol) used for cleaning is typically (after density separation) emitted to WWTP
- Proposal for criteria requirement:
  - UV lacquer residues and other lacquer residues containing solvents or other environmental hazardous substances must be treated as chemical waste (2.4.8)
  
- (2.4.2) LAMINATING:
  - Laminating with thin plastic film is typically done with water-based adhesives or termo-film and is done by a specialist company (outside printing firm). The film is typically made of e.g. polyethene, polypropene (biaxial polypropene is dominant in Sweden)
  - Laminating is done with 100 – 120° C (termo-film) or 70 – 100° C (water based adhesives)
  - Cleaning is done by using cloth/paper serviettes, water and/or solvents (alcohols, aromates, ketones, esters) once every day or week. Used water goes to sewer and solvents are partly emitted to air
- (2.4.5) CUTTING:
  - Typically separate machine in sheet fed offset. Resulting in paper waste
- (2.4.6.) STAPLING
  - Used for e.g. leaflets. Cut off paper and small amounts of metal wire as waste
- (2.4.3) GLUEING:
  - Hot adhesives, cold adhesives and PUR adhesives are typically used
  - Hot adhesives are typically used for catalogues and magazines. Content: resin (vinylacetate/polyetene) wax, rosin, fillers and stabilisers
  - Cold adhesives are used for books (e.g. IR drying). Dispersion of polyvinyl acetate (particles) in water, benzothiazoloner (<0.1%), phthalates (e.g. dibutyl phthalate)
  - Cleaning of machinery after use of hot adhesives is typically done by warming up and using cloth. Cleaning after use of cold adhesives is done with water, which ends up in the sewer. “Very dry” adhesives may be removed by use of ethyl acetate or gasoline. The amount of waste water is relatively small
- Proposal for criteria requirement:
  - Adhesive residues containing solvents or other environmental hazardous substances must be treated as chemical waste (2.4.8)

- (2.4.7) ADDRESSING:
- Typically very small amounts of ink (ink jet) are used for marking the products
- (2.4.8) PACKAGING:
- “Typically wood pallet, paper or “shrink plastic”

(3) Reuse of paper (8 paper and pulp companies, and 2 “sorting companies”, qualitative questionnaires)

- Carbon paper gives problems even in small amounts
- Paper with high wet strength and coloured paper only give problems if in big amounts
- Black and coloured ink (offset) no problem
- UV-lacquer and “offset lacquer” a problem even if in small amounts
- Water based lacquer is a problem if in big amounts
- Water based adhesive for lamination is a problem even if in small amounts
- Water based adhesives (acrylic based (highest problem); dextrin based (lowest problem)) for gluing a problem if in big amounts
- Hotmelt a problem even if in small amounts
- Miscellaneous: E.g. scratch cards and labels a problem even if in small amounts

(4) Proposal for general requirement for chemicals

- No use of chemicals with > 1% content of an environmental hazardous substance or totally 2% of environmental hazardous substances (according to Council Directive 67/548/ECC) (2.4.8)

(4) Proposal for general requirement for solvent emission to air

- Emission must be estimated by use of mass balances (2.4.8)

(4) Proposal for general requirement for lacquer, adhesives and material for lamination

- Biocides must be readily biodegradable and non bioaccumulative (according to Council Directive 67/548/ECC, 22. amendment)

### 5.3 Overview: Criteria for Ecolabelling of Printed Matter (offset)

This commented overview is based on the criteria document “Ecolabelling of Printed Matter”, version 3.1 /3/.

### 5.3.1 Criteria requirements

#### (4.2) Content of printed matter

- no metal dyes (ERROR: must be metal containing pigments, except Cu in phthalocyanine's) *exceptions*
- no carbon paper *exceptions*
- no metal foil printing *exceptions*
- no chlorine based plastics (must be PVC)
- no phthalates

Paper must be ecolabelled (Swan or Flower) or fulfil the criteria for paper ecolabelling

#### (4.3) Requirements for production phase highest weight is on printing (8) followed by page production and finishing (3) and plate making (2)

##### Page production

- collection and processing of waste
- treatment and/or reuse of rinsing water before emission to WWTP (max 10mg Ag/m<sup>2</sup> plate)
- punishment for content of algaecide in rinsing solution
- reward for CTP
- Printing form, i.e. plate-making (offset) highest weight on solvent based developers and silver-based plates
- collection and processing of waste (chemical + filters)
- no silver-based plates
- solvent based developers banned or punished (dry offset)
- no plate developers better than use of water based developers
- CTP assessed the same way as dry offset (not rewarded)
- silver based CTP plates allowed – demands same as for page production
- Printing (offset) highest weight is on alcohol consumption and vapour pressure of cleaning agents
- inks based on vegetable oil better than traditional better than UV-inks
- cleaning agents; low consumption rewarded (FU: L/ton paper) (3.6->1.2)
- cleaning agents; aromatic content must be < 1% (exception; 2% of total consumption may contain max. 50% aromatics)
- cleaning agents; low vapour pressure rewarded
- cleaning agents; vegetable oil based types and water based types (acid/base) rewarded higher than ecolabelled non-vegetable types
- fountain solution; low alcohol consumption rewarded but alcohol free (wet offset) better and no fountain solution best (dry offset)
- collection and processing of waste
- waste water from cleaning; waste water treatment demanded
- waste water from cleaning; collection and destruction of waste water punished – better is filtering (particles < 5µm in effluent) and best is separation (e.g. carbon filter; non

polar aliphatics max. 50 mg/l in effluent) and no waste water at all

- waste fountain solution; same as for wastewater from cleaning but also requirement for max. 20% inhibition of nitrification if best score is obtained
- waste fountain solution; readily biodegradable surfactants better than non readily biodegradable types
- Finishing highest weight is on lamination (4) followed by lacquering and adhesives (3)
- collection and processing of waste
- lamination; no self-adhesive non water soluble adhesives must be used and only books, catalogues, binders and folders must be laminated
- solvent based adhesives worst, PUR-based glue and thermofoil better but water based glue best
- lacquering; solvent based lacquer (> 15% VOC) worst, UV lacquer better but water based types best
- adhesives; no self-adhesive non water soluble adhesives must be used
- adhesives; solvent based worst, PUR-based and hot melt better, animal adhesive and dispersion adhesive (water based) even better but ecolabelled types best
- Paper cutting waste
- max. 20% by weight or area

#### (4.4) Requirements for chemicals

##### Cleaning processes (cleaning agents)

- banned; phthalates, nonylphenols, ethylene glycol ethers (CAS No. 111-77-3; 111-90-0; 109-86-4; 110-80-5) and halogenated hydrocarbons (and chromium? Only mentioned in Appendix 2 – Declaration; not in § 4.4.1.2)
- aromatics <= 50% by weight
- Printing processes: Damping system (fountain solution)
- biocides must not be potentially bioaccumulative
- banned; phthalates, nonylphenols, ethylene glycol ethers (CAS No. 111-77-3; 111-90-0; 109-86-4; 110-80-5) and halogenated hydrocarbons (and chromium? Only mentioned in Appendix 3 – Declaration; not in § 4.4.1.2)
- Printing processes: Printing (inks, varnishes and toner)
- max. 2% content of substances classified as environmentally hazardous and no products (preparations) classified as environmentally hazardous (exception, UV inks may contain 1% environmentally hazardous substances after photo cure)
- no heavy metals, aluminium or cobber based chemicals (except Cu in phthalocyanines) and Pb, Cd, Hg, CrVI max. 100 ppm in total
- banned; phthalates, nonylphenols, ethylene glycol ethers (CAS No. 111-77-3; 111-90-0; 109-86-4; 110-80-5) and halogenated hydrocarbons
- Finishing processes (laminates, lacquer and adhesives)
- max. 2% content of substances classified as environmentally hazardous and no products (preparations) classified as environmentally hazardous

- banned; phthalates, nonylphenols, ethylene glycol ethers (CAS No. 111-77-3; 111-90-0; 109-86-4; 110-80-5) and halogenated hydrocarbons
- Requirements for waste
- electronic waste must be handled for processing, aluminium plates and paper must be recycled and a waste management plan for sorting at source e.g. hazardous waste, plastic, paper must exist

#### 5.4 References

/1/ Brodin, L. and Korostenski, J. (1995). Miljøbelastningar från grafisk industri i Sverige. Grafiska Miljögruppen. Report version 2 (15-04-1995). Report to SFS

/2/ Brodin, L. and Korostenski, J. (1997). Miljøbelastningar från grafisk industri i Sverige: Screen-, Flexo-, Digitaltryck och Efterbearbetning. Preliminär rapport. Kompletterad och reviderad version. Grafiska Miljögruppen. Report version 3 (18-06-1997). Report to SFS

/3/ Ecolabelling of Printed Matter. Criteria document. 21 March 2001 – 14 March 2005. Version 3.1. Nordic Ecolabelling. (<http://www.svanen.nu/DocEng/041e.pdf>)

/4/ Vejledning fra Miljøstyrelsen Nr. 11, 2002. Tilslutning af industrispildevand til offentlige spildevandsanlæg (“Spildevandsvejledningen”). Miljøstyrelsen. Miljøministeriet. (Danish EPA)

# Significant environmental impacts

In	Out
<b>Energy and water resources</b>	
Electricity	
Heating	
Water	Wastewater
<b>Film and plate making</b>	
Film	Used film and plate developer
Fixer	Used fixer
Film developer	Used film developer
Plates	Film/paper containing silver
Plate developer	Used rinsing solution from film developing
Algecides	Filters/sludge, ion exchange material
	Used plates
<b>Materials in printed matter</b>	
Paper	Printed matter
Inks, mineral-based	Paper waste
Inks, vegetable-based	Ink and wash residues
Varnish	
Glue	
<b>Washing agents</b>	
Washes for XX point	
Washes for XX point	
Washes for XX point	
<b>Additives etc.</b>	
Alcohol	Discarded damping solution
Damping solution additives	Discarded wash solution
	Cloths
	Combustible waste
	Plastic
	Electronic waste



## Elements in environmental management systems

1. Objective
2. Environmental strategy
3. Organisation and responsibility
4. Environmental meetings and management review
5. Document management
6. Legislation and agreements
7. Employees
8. Suppliers/partners
9. Purchasing
10. Investments
11. Enquiries
12. Sales
13. Non-conformances
14. Environmental accounts
15. Environmental audit
16. Environmental statement
17. Contingency plan
18. Instructions for sorting waste
19. Instructions for Swan label printed matter
20. Instructions for prepress
21. Instructions for print
22. Instructions for bookbinding



## Effect and manageability

Sheet feed offset	Effect – are the requirements effective?	Can the company meet the requirements?
Paper fulfils eco-label criteria	For the most part, of the paper normally used meets the environmental label criteria. The effect may therefore be minimal, as pretty much the same paper qualities are used whether the printed matter is Swan labelled or not.	Yes
Page production		
Collection of photographic chemicals and hazardous waste	Legislative requirement in DK	Yes
Silver in rinsing solution max. 10 mg/m <sup>2</sup>	By far the majority of licence owners in DK have decided to install equipment for recirculating rinsing solution. Used rinsing solution is sent for controlled destruction. Discharge is thus 0 mg silver/m <sup>2</sup> . The requirement has thus had the effect that the volume of discharged wastewater (and thus also silver) from film developing has been reduced in DK.	The requirement to measure mg silver per m <sup>2</sup> is difficult to control for individual printed matter.
Rinsing solution treatment	See above	See above
Form production		
Collection of hazardous waste	Legislative requirement	Yes
No silver-based plates for making traditional plates (wet offset).	Not used in practice as traditional plates. Therefore no effect.	Yes
Silver-based plates for making CtP plates. Silver in rinsing solution max. 10 mg/m <sup>2</sup>	It is normal practice that rinsing solution used for making CtP plates is recirculated and destroyed. Therefore the requirement has no effect.	Yes
No solvent-based agents for making traditional plates (wet	Not used in practice. Therefore no effect.	Yes

Sheet feed offset	Effect – are the requirements effective?	Can the company meet the requirements?
offset) and CtP plates.		
Printing incl. cleaning		
Inks	Reward for vegetable inks has had the effect that several printing companies have been motivated to use vegetable inks.	Yes
Max limits on washing, max. 3.6 litre/ton paper	Has increased focus on the area, but has not had the desired effect, as the method of calculation is not significant for the company's consumption. The use of washing agents does not depend on the volume of paper used (in tons), but on a number of other parameters. In fact companies, which use high gram weights, are rewarded (a large volume of paper gives a better key figure).	In practice cannot be controlled per individual printed matter.
Max limits on alcohol, max. 6 kg/tonnes	Has increased focus on the area, but has not had the desired effect, as the method of calculation is not significant for the company's consumption. The use of alcohol does not depend on the volume of paper used (in tons), but on a number of other parameters. In fact companies, which use high gram weights, are rewarded (a large volume of paper gives a better key figure).	In practice cannot be controlled per individual printed matter.
Inks, washing agents etc. Are collected for destruction or recycling.	Legislative requirement	Yes
Wash or energy recovery of cloths	Normal practice in DK is that cloths are washed (by specialist companies) and reused. The requirement has no effect in DK.	Yes
Treatment of waste washing water	Has meant that large volumes of water are sent for destruction instead of being discharged into the public wastewater system. However, it has not really been established which	Yes

Sheet feed offset	Effect – are the requirements effective?	Can the company meet the requirements?
	method of disposal is the least environmentally damaging: transport and destruction or discharge into the public wastewater system. Assessment suggests that it depends on the particular water treatment plant in the locality.	
Damping solutions	Has minimised the consumption of damping solution concentrates containing tensides, which are not readily biodegradable.	Yes
Treatment of waste damping solution	Has meant that large volumes of water have been sent for destruction, without it being established what is the least environmentally damaging method of disposal: transport and destruction or discharge into the public wastewater system. Assessment suggests that it depends on the particular water treatment plant in the locality.	Yes
<b>Finishing</b>		
Wash or energy recovery of cloths and rags	Normal practice in DK is that cloths are washed (by specialist companies) and reused. The requirement has no effect in DK.	Yes
Lamination	Only a minimal effect.	Yes
Self-adhesive non-water soluble adhesives not allowed	Only a minimal effect.	Yes
Lacquering	Only a minimal effect.	Yes
Adhesives	Only a minimal effect.	Yes
<b>Production requirements</b>		
Washing agents, damping solution concentrates, damping solution additives and algecides, printing ink, overprint varnish, toner, adhesive, lacquer and laminate must not contain phthalates, nonylphenols (or derivatives of these),	Not possible to evaluate	Yes

Sheet feed offset	Effect – are the requirements effective?	Can the company meet the requirements?
ethylene glycol ethers (Cas: 111-77-3, 111-90-0, 109-86-4, 110-80-5) or halogenated hydrocarbons		
Aromatic content of washing agents must be below 1%. Exception: 2% of total consumption may contain max. 50% aromates.	Has partially phased out the use of washing agents with a vapour pressure over 5 kPa. Has phased out the use of washing agents with an aromatic content over 1%. However, it should be noted that these products were previously only used in limited volumes.	Yes
Biocides in damping solution must not be potentially bioaccumulable	Not possible to evaluate	Yes
Printing ink, overprint varnish, toner, adhesive, lacquer and laminate must not contain a total of more than 2% by weight of substances classified as environmentally hazardous in accordance with EU Directive 67/548/EEC...	Not possible to evaluate	Yes
Pigments in printing ink/toner must not be based on heavy metals, aluminium or copper. Exception: copper phthalocyanine.	Not normal practice. Therefore only a limited effect.	Yes
The content of the following heavy metals in printing inks, toners or ink must not exceed a total of 100 ppm: Lead, cadmium, mercury and hexavalent chromium	Not normal practice. Therefore only a limited effect.	Yes
Waste management requirements		
Cutting waste less than 20%	Only a minimal effect. Cutting waste, whether for printed matter with the Swan label or without it is under 20%, as companies try to use paper optimally for financial reasons.	Yes
Waste man. plan incl. sorting and handling	Provides a good overview. However, has only a minimal effect. Sorting is a legal requirement in DK.	Yes
The licence-holder is required to sort and handle for processing of electronic waste	Legislative requirement	Yes

Sheet feed offset	Effect – are the requirements effective?	Can the company meet the requirements?
Aluminium printing plates and waste paper from production must be submitted for recycling	No effect. The plates are sent for recycling, whether the company has a Swan label licence or not, as they have a not inconsiderable value (approx. 1 euro/kg).	Yes

