



# report

IVL Swedish Environmental Research Institute

Evaluation of Nordic Swan eco-  
labelling criteria documents for 8  
groups of products containing  
surface active agents

Peter Solyom and Lars-Gunnar Lindfors

B 1307

Stockholm, October 1998

# IVL

Institutet för Vatten- och Luftvårdsforskning  
Swedish Environmental Research Institute

<b>Organisation/Organization</b> Institutet för Vatten- och Luftvårdsforskning <b>Adress/Address</b> Box 21060 100 31 STOCKHOLM <b>Telefonnr/Telephone</b> 08-729 15 00	<b>RAPPORTSAMMANFATTNING</b> <b>Report Summary</b> <b>Projekttitel/Project title:</b> Evaluation of Nordic eco-labelling criteria for 8 groups of products containing surface active agents <b>Anslagsgivare för projektet/Project sponsor</b> <b>KTF, Sweden</b>
<b>Rapportförfattare, author</b>  Peter Solyom, Dr. Eng. and Lars-Gunnar Lindfors, Research Director	
<b>Rapportens titel och undertitel/Title and subtitle of the report</b>  Evaluation of Nordic eco-labelling criteria document for 8 product groups	
<b>Sammanfattning/Summary</b> The investigation assesses 8 Nordic Swan criteria documents for eco-labelling of various product groups containing surface-active agents concerning criteria setting and the scoring procedures of products. This study discusses the criteria documents with the intention to identify options for improvements including improved transparency, but does not in any way evaluate the Nordic ecolabelling system itself, nor evaluate the environmental effectiveness of the chosen criteria. <b>Fulfilment of the intention of the Nordic Council of Ministers (NMR)</b> <ul style="list-style-type: none"><li>• The intentions of NMR are not fulfilled in the studied 8 criteria documents in regard to the use of life-cycle approach in the criteria setting process, neither for defining the environmental impact nor as basis for the choice of scoring parameter in the criteria.</li><li>• The precautionary principle is reflected in all the studied criteria documents but it is based only on the hazardous properties of the ingredients in various product groups. No complete risk assessments of the individual product ingredients are performed. The substitution principle is also a part of the criteria documents but no consequence evaluations are performed.</li></ul> <b>Scientific evaluations of parameters for assessment of products</b> <ul style="list-style-type: none"><li>• The calculation of ecotoxicity used for scoring of products is not scientifically justified, since the toxicity of single compounds is usually not additive.</li><li>• No motivation or background data is given for the specified limits of single ingredients.</li><li>• A uniform assessment of specific ingredients is desirable the different criteria.</li></ul>	
<b>Nyckelord samt ev. anknytning till geografiskt område, näringsgren eller vattendrag/Keywords</b> Eco-labelling, surfactants, eco-toxicity of preparations, LCA, scoring	
<b>Bibliografiska uppgifter/Bibliographic data</b> <b>IVL Rapport B 1307</b>	
<b>Beställningsadress för rapporten/Ordering address</b>  IVL, Publikationsservice, Box 21060, S-100 31 Stockholm, Sweden	

## Content

Summary .....	4
Introduction.....	6
1. Household detergents 1995-1999, Version 3.4 .....	7
2. Hair shampoo, shower-shampoo, liquid and solid soap 1996-1999, version 1.1 ..	12
3. Cleaning and protecting products for cars 1997-2000, Version 2.1 .....	15
4. Sanitary cleaner 1994 - 1999, Version 1.2 .....	17
5. Dishwashing detergent 1997-2001 Version 2.0 .....	18
6. All purpose cleaner 1995-1998 Version 1.3.....	20
7. Detergents for manual dishwash 1996-1999, Version 1,1.....	22
8. Filmforming floor polish and wax 1996 - 1999 Version 1.0.....	24
Conclusions.....	26
Summary of Conclusions.....	31
Fulfilment of the intention of the NMR.....	31
Scientific evaluations of parameters for assessment of products .....	31

## Summary

The investigation assesses 8 Nordic Swan criteria documents for eco-labelling of various product groups containing surface-active agents. The study intends to scrutinise the documents with focus on and restricted to two issues related to the criteria setting procedure, namely the fulfilment of the intentions of Nordic Council of Ministers (NMR) concerning requirements for criteria setting and the scientific evaluation of the scoring procedures of products. This study discusses the criteria documents with the intention to identify options for improvements including improved transparency, but does not in any way evaluate the Nordic ecolabelling system itself, nor evaluate the environmental effectiveness of the chosen criteria.

Fulfilment of the intention of the NMR:

### **Life-cycle approach**

The intentions of the NMR to use a life-cycle approach both for identifying the environmental impacts associated with the products and as a basis for the choice of scoring parameters in the criteria are not fulfilled. Recent life-cycle assessment studies of some of the products identify energy use as one major environmental issue. This is not discussed in these criteria documents as opposite to criteria documents for several other product groups.

### **Precautionary and substitution principles**

The precautionary principle is reflected in all the criteria documents but it is based only on the hazardous properties of the ingredients in the various product groups. Emissions of hazardous chemicals can become a risk to the environment if the environment is exposed to high enough concentrations of the chemicals. No complete risk assessments of the individual product ingredients have been performed.

The substitution principle is also followed in the criteria documents but no evaluation of the consequences of these substitutions has been performed.

### **Quality and functionality**

No functionality test is specified for shampoos and soaps, sanitary cleaners and all-purpose cleaners.

The quality and functionality/efficiency of the products is one of the most important properties. According to recent LCA studies, the usage phase of the products is associated with major environmental impacts through energy use, which can be positively influenced by enhanced product efficiency (dosage, temperature, etc.) Dosage is considered in some criteria documents however not other types of functional qualities

of environmental importance.

**Scientific evaluation of the parameters for assessment of product in the criteria**

Assessment of eco-toxicity.

The approach to calculate an ecotoxicity score is not scientifically justified. Because of possible and probable chemical interactions between various ingredients, toxicity of single compounds is not necessarily additive.

There are no background data given in the criteria documents that support the limits, which have been set for the individual ingredients.

## Introduction

The following investigation is an analysis of 8 Nordic Swan criteria document for eco-labelling of various product groups containing surface active agents. The investigation intends to scrutinise the documents alone concerning (and restricted to) two issues related to the criteria setting procedure, namely the fulfilment of the intentions of NMR (Nordic Council of Ministers) concerning requirements for criteria setting and the scientific evaluation of the scoring procedures of products. This study discusses the criteria documents with the intention to identify options for improvements including improved transparency, but does not in any way evaluate the Nordic eco-labelling system itself, nor evaluate the environmental effectiveness of the chosen criteria.

According to the principles for eco-labelling in the Nordic countries the criteria setting procedure for labelling should be based on the following principles (recommendations of the Nordic Council of Ministers, NMR, and 24 January 1996):

### Environmental Aspects.

"The environmental effects of the product throughout its entire life cycle shall be defined and used as basis for choosing a limited number of parameters. Some important factors to keep in mind are the choice of raw material, energy and resource application, emissions into air, water and soil, noise, odour and waste, in connection with its production, as well as its transportation, use and final depositing. Other important factors are the useful life of the products and their ability to be repaired (functionality). Environmental principles such as due care and substitution should also be included among the considerations to be taken into account when developing criteria".

### Quality and Performance Requirements.

"Eco-labelling must not entail any relinquishment of the requirements made to the quality and performance requirements. Therefore, the criteria should include the demand for testing of performance and/or quality."

### Definition of Product Group.

"A product group shall be defined on the basis of the field of application for the products. The establishment of the criteria should, therefore, be based on a comparative assessment of the products included in the product group."

### Level of Requirements.

"Environmental protection requirements should be set at a high level. The level should be seen in relation to the official rules in the participating Nordic countries. In the establishment of the criteria, the market share for the products expected to meet the criteria should not exceed one third of the total Nordic market."

## 1. Household detergents 1995-1999, Version 3.4

### *Environmental Aspects*

One of the most elaborated LCAs conducted is the German "Produktenlinieanalyse Waschen und Waschmittel, Umweltbundesamt UBA FB 97-009". The German study came to the conclusion that the major environmental impacts associated with household detergents during their life cycles are generated during the use of the detergents by the use of energy. Between 60 and 80% of the total energy consumed is used for the operation of the washing machine, heating of the wash water and water consumption. The production of ingredients contributed about 20 and 30% to the energy consumption, while the packaging, manufacturing, distribution and disposal of the detergent made up 2 - 5% of the energy used. Emissions to water and solid wastes are dominated by the disposal of detergents.

There are no life-cycle considerations included in the criteria document, and thus no documentation of LCA of household detergents is referred to. There are a number of various LCA studies available for this group of products, but the criteria document was probably written before these were published.

The major environmental impact of the household detergents according to the criteria document is assigned to the disposal of the product after use in treatment plants or receiving water. This is not completely correct since according to the above-mentioned UBA LCA, one major environmental impact of the product is generated by the use of energy in the usage phase. This fact is also mentioned in qualitative terms in the criteria document ("considerable environmental gain") along with a claim that this impact is difficult to regulate by eco-labelling. Thus, it is not considered

The lack of full life-cycle considerations in the criteria document is contradictory to the recommendations of NMR. "Difficult" is not a justification.

An LCA view would be appropriate especially under point 3.2. In the criteria document (description of the product), which describes the importance of the 4 factors that influence the results of the washing operation (mechanical work, time, temperature and input of detergent).

The choice of parameters in the scoring of household detergents (see below) does not reflect all major environmental impacts associated with detergents during their life cycles. The scoring only addresses the environmental properties and amount of the ingredients and the packaging of the product.

### *Quality and Performance Requirements*

The producer must secure the Quality and Performance Requirements of the household detergents by suitable composition of the detergent with the limitations given in the criteria document.

The household detergent must of course be effective at a recommended dosage as the criteria document states. However the efficiency (performance) is not a part of the scoring.

The criteria document contains a test method for the evaluation of washing machine (IEC 456/prEN 60456) and two methods for testing of tolerance of textiles against washing and efficiency of household detergents (ISO 6330, ISO 4312).

None of the methods is accurate enough to be a basis for scoring. The methods are used to guarantee the function of the products that is a minimum requirement.

### *Definition of Product Group*

The Definition of Product Group and its ingredients is described in a correct and transparent manner.

### *Level of Requirements/choice of quantitative criteria*

The quantitative criteria given in the document are based on the amount and types of chemical substances in the products, related to the recommended dosage of detergent. These criteria limit the use and discharge of organic and inorganic chemicals with potentially adverse environmental properties, and three of the environmental targets given by the Swedish EPA are effected, namely

The discharge of POP (degradation products of certain surfactants).

The eutrofication by limiting the use of phosphorus.

The fate of metals in the environment by limitation of the use of certain chelators.

No other environmental target is effected by the quantitative criteria.

The criterion for eco-labelling is based on the inherent environmental **properties** of the product and that of the packaging. The inherent environmental properties of chemicals characterise the **hazard** or the inherent possibility that a chemical will harm the environment. Upon discharge of the chemical at concentrations exceeding no effect levels (NOEL) in the environment this hazard becomes a **risk**.

The criteria document for household detergent does not contain any risk assessment of the chemicals present in the product.

A risk assessment consists of an exposure assessment, an effect assessment (based on inherent properties) and a risk characterisation.

The concentration of the chemical in the environment is predicted (predicted effect concentration, **PEC**) in the **exposure assessment** step. The following data about the chemical is necessary for this prediction: the amount used (per year), the biodegradability and the dilution factor, locally, regionally or for greater area.

The **effect assessment** is based on the inherent properties of the chemical. Ecotoxicity data on the acute or/and chronic level (for instance long-term toxicity, reproduction, etc.) is needed for fish, invertebrates and algae (acute toxicity:  $EC_{50}/LC_{50}$ ,  $LC_0$ , chronic toxicity: no-observed effect concentration, NOEC). Depending on available ecotoxicity data the predicted no-effect level concentration, **PNEC**, is estimated by using division with safety factors of 1000 (single species, acute toxicity) and down to 10 (most sensitive species, chronic level, NOEC).

The **risk characterisation** ratio is calculated as **PEC/PNEC**. If the ratio is less than 1, there is no immediate concern for environmental effects. If the ratio is  $>1$ , this indicates the need for risk management measures, such as limitation or omission the use of the chemical.

The possibility for persistent (non-biodegradable) transformation products and bioaccumulation properties must be included in the assessment of chemicals.

Many industrially used and product related chemicals have been evaluated using these internationally accepted methods (by EU, KEMI in Sweden, etc.).

#### Requirement on specific ingredients

The criteria for single ingredients in the household detergent state that ingredients, which are classified as hazardous for the environment as R50+R53, R51+R53, or R52+R53, may not exceed 0.12 g/per wash. The corresponding criteria for ingredients classified R50 (very toxic, but biodegradable) is 7.5 g/per wash

There are no background data given in the document to support these limits.

The method of expressing the sum of dosage of hazardous chemicals and the limits is against not scientifically justified evaluation. The classification of hazardous substances is based on the toxicity, degradability and long term effects of the chemical substance, in this case an ingredient of the detergent.

None of these properties are additive; the ecotoxicity of single chemicals cannot be added to each other. There may be synergistic and antagonistic actions between chemicals, which means that the ecotoxicity can be higher or lower or even eliminated.

One example is the action between a cationic and an anionic chemical: they "neutralise" each other's toxicity toward various aquatic (and other) organisms including bacteria. The biodegradation of a cationic substance is hence very difficult to test because of high toxicity towards degrading bacteria. However in the presence of an anionic compound, the toxicity is "neutralised" and the degradation proceeds for modern cationic surface active agents without any problem. The same is valid when a chemical with a cationic function is discharged into the aquatic or terrestrial environment, which contains negatively charged surfaces.

#### The calculation matrix

The calculation of the score of the product as described in the document is based on:

- The amount detergent used per wash, K
- The ecotoxicity and biodegradability, GN
- The content of phosphorus, F
- The content of difficulty soluble inorganic compounds, SOO
- Easily water-soluble inorganic ingredients, LOO
- Inherently degradable organic compounds, IFN
- Anaerobically non-degradable compounds, IAN
- The amount of organic compounds as TOC
- The weight of packaging in relation to the amount of product, VNF.

The calculation is performed according to a formula containing given constants. The various factors are weighted differently with the ecotoxicity and degradability as the most important parts of the scoring, followed by the amount of phosphorus and the total amount of detergent per wash.

The calculation of the contribution of ecotoxicity and degradability (GN) is again based on summation of factors, amongst others  $TOX_i$  for individual ingredients. This is again against accepted scientific principles, because toxicity of single ingredients is not necessarily mathematically additive. According to the proposal concerning preparations (products containing more than 1 component), 96/C 283/01: *"Where laboratory tests are conducted, they must be carried out on the preparation as placed on the market"*.

As mentioned previously the criteria and scoring are based on inherent hazardous properties of the ingredients in the detergent such as ecotoxicity, biodegradability and bioaccumulation. Emissions of hazardous chemicals will turn into a risk in the environment if the environment is exposed to high concentrations of the unaltered chemicals. The calculation of the scoring factor GN takes the biodegradability into consideration, but a complete Risk Assessment is barely performed on the list of chemicals which is used in the calculation of GN. The ecotoxicity of surfactants at the acute level is the consequence of the lowering of surface tension. This property of a surfactant is eliminated by primary degradation, which is an immediate step in biodegradation, therefore it eliminates the acute ecotoxicity of the surfactant. Most of the surfactants used in laundry detergents are ready biodegradable and therefore the inclusion of inherent ecotoxicity in the scoring may be questioned.

The limitation of the use of phosphorous (5.2 and 5.3.3) is adapted to Norwegian rules. This rule is based on the fact that sewage treatment in Norway was not generally designed for phosphorous elimination. An LCA evaluating the use of phosphorous compared with the use of zeolite, including the effect of an increased share of surface active agents in the detergent on sewage treatment and the effect on the life-length of textiles, would be appropriate.

Sparingly soluble inorganic substances in the detergents are zeolites. The weighting factor could be questioned because zeolites in excess may influence both the sewage treatment plants by decreasing microbial activity of sludge and the life-length of textile and the working environment in handling the textiles after washing operation.

## **2. Hair shampoo, shower-shampoo, liquid and solid soap 1996-1999, version 1.1**

### *Environmental Aspects*

The criteria document for hair shampoo, shower shampoo, liquid and solid soap stresses the difficulties in performing a quantitative LCA of the products due to lack of data for the various ingredients and it claims that the product ingredients in the product group are so similar. An LCA would therefore not exhibit any differences amongst various products from the environmental point of view. This seems in a way true, because the products themselves represent a minor part of the used resources. Most of the resources are used in obtaining warm water in connection with the use of products (LCA-Chalmers).

No life cycle considerations have been applied in the criteria document to identify the major environmental impacts. Consequently the choice of parameters in the criteria document does not reflect one major environmental impact - which according to the mentioned LCA study - is connected to the energy used in obtaining warm water during use of the products. This is possible to assess if a life cycle view is applied and may be included in the criteria.

The criteria address the environmental properties of the product ingredients and since these are mainly surfactants with reasonably high environmental compatibility, this type of evaluation will not show any significant differences between products.

### *Quality and Performance Requirements*

The criteria document does not contain any references for the test of Quality and Performance Requirements of the product group. This seems to be in contradiction to the recommendations given by the NMR.

### *Definition of Product Group/Level of Requirements*

The definition of the products and the ingredients of the products are described clearly in the criteria document.

Chapter 4 in the criteria document describes in general terms the environmental and health hazards of the product. The document states that the criteria are developed on the basis of 5 main targets. One of the targets is however formulated unclear:

"The products should have sufficient efficiency. This is secured by calculating the environmental load based from the active content of the product".

This has no simple or direct correlation to the efficiency of the product.

In Chapter 5 the criteria for eco-labelling are given for the ingredients of the products and the packaging of the product.

The criteria in the document deal with the limitation of use and discharge of organic and inorganic chemicals with potentially adverse environmental properties. Two of the environmental targets given by the Swedish EPA are effected, namely

The discharge of POP (degradation products of certain surfactants).

The fate of metals in the environment by limitation of the use of EDTA.  
(Recent research has discussed the biodegradability of EDTA under specific conditions in biological treatment plants.)

The criteria in the document do not contain evaluation parameter that addresses the energy use, which would reflect one major environmental impact in the life cycle of the products.

The criteria document does not contain a risk assessment (RA) of the chemicals present in the product.

The performance of the RA is briefly described in the comments of the criteria document for Household detergents.

#### Requirement for specific ingredients

Classified ingredients with the risk phrases R50+R53, R51+R53 or R52+R53 are limited to a total of 6 mg/g active ingredients of the product (sum of ingredients except water). There is *no motivation or background information* for this limit. The summation of ingredients with various toxicity properties is also contrary to accepted scientific principles as toxicity, especially that of surface active agents (but also other ingredients) can react with each other and neutralise or decrease toxicity.

R50 classified ingredients (with no other risk phrases) are limited to 500 mg/g active content. Again there is *no background information* in the document for this limit however it is mentioned that surface-active agents are mostly classified as R50.

The specific criteria for aerobically not readily biodegradable surface-active agents are limited to 15 mg/g active content. No background information is given for this limit. The same limit is placed on the content of anaerobically non-degradable surfactants and this is not motivated either.

#### Calculation matrix

Under 5.4 in the document, the environmental load of the product is related to the active

content. The evaluation is based on a toxicity score and a score for the packaging; the previous score is of course of higher importance (weighting factor). However, the evaluation scheme contains specified numerical values with no motivation and *no background data* as how these have been calculated.

The toxicity scoring is calculated separately for each ingredient (both organic and inorganic) as the critical dilution volume, CDV. The CDV is calculated using the amount of the ingredient per total active ingredients (mg/g), the toxicity of the component and a safety factor (SF) depending on the available number of acute toxicity values (3 species = 1, 2 species = 5, 1 species = 10). The toxicity scoring takes also degradability properties into consideration. The total toxicity score is obtained by adding the individual scores for each component. *This is contrary to accepted scientific principles especially for surface active agents because*

- a) It is based on inherent properties of the ingredients and
- b) toxicity's of ingredients are not additive. According to the proposal concerning preparations (products containing more than 1 component), 96/C 283/01: "Where laboratory tests are conducted, they must be carried out on the preparation as placed on the market".

The scoring systems in the various criteria documents are not uniform and a harmonisation of definitions and abbreviations would be desirable.

### **3. Cleaning and protecting products for cars 1997-2000, Version 2.1**

#### *Environmental Aspects*

There is no life cycle consideration evaluation according to the NMR principles for eco-labelling documented in the criteria document. It is understandable because the document comprises three different product groups, namely non-dilutable degreasing agents, dilutable car shampoos and waxes. This would make a quantitative LCA evaluation complicated, but it is possible to perform LCA for the degreasing agents and the car shampoos, as they contain relatively similar ingredients.

A further separation of the criteria document into car cleaning products that are used professionally and wax products would be more suitable.

No previous LCA studies for this product group is available. It is therefore difficult to assess whether the criteria parameters address the limitation of major environmental impacts during the life cycle of the products. However, similar to other surfactant containing products, except for protecting (wax and polish), the energy used during the usage of the products may possibly generate one major environmental impact.

The general description of the potential environmental effects is correct (from production of raw material, from the use of the products and where and how the product is used), however the effects of especially highly degreasing agents on sewage treatment are not mentioned. (Increased use of microemulsions - increased discharge of surfactants and hydrocarbons.)

#### *Quality and Performance Requirements*

The quality and function of non-diluted and diluted products should be tested. The test method for car shampoo is however not specified. The criterion for the function is that the product shows at least the same efficiency as two reference products that are not specified in the document.

The functionality test for degreasing products is described in a more detailed manner, but the reference products are not specified.

There is no scoring of efficiency for the products, nor is the functionality included in the total scoring of the products.

### *Definition of Product Group*

The description of the product group and the ingredients of cleaning and polishing agents are described clearly, however, the presence of higher alcohol's with more than 10 C atoms (ingredients in degreasing agents used as microemulsions) are not mentioned.

### *Level of Requirements/Choice of quantitative criteria*

The document does not contain any risk assessment of the ingredients. (See under comments of criteria for Household detergents.)

### Requirement on specific ingredients

The criteria for various ingredients with hazard labelling in the products are related to the concentrated product (wax, polish and degreasing) and to the volume of diluted products (shampoo). The criteria are given as concentrations. The hazards labelling of the ingredients are based on inherent ecotoxic properties of single substances in combination with other environmental properties. Upon mixing the toxicity of especially surface active substances, the toxicity changes. The summation of ecotoxic substances (R50-R53) is not scientifically justified evaluation.

The use of NTA is permitted up to a certain concentration in this document while in other criteria document it is forbidden to be used. This is confusing also because EDTA is permitted up to a certain concentration in other products. The substitution principle probably gives the rationale for this, but no explanations are given.

Uniformity amongst criteria for various products would be desirable.

### Calculation matrix

The scoring of the products is calculated from the toxicity and degradability ( $GN_T$ ), the not completely degradable ingredients (IFN) and the anaerobically non-degradable ingredients (IAN). The  $GN_T$  has the highest weight factor. The  $GN_T$  is calculated as a sum of inherent ecotoxic properties of single ingredients and this is not scientifically justified evaluation because of possible interactions amongst various ingredients in the product, especially surface active agents. The biodegradability of especially cationic ingredients may increase as a consequence of decrease or elimination of toxicity to degrading bacteria.

No background information for the chosen numerical values in the calculation matrix is given in the criteria document.

Definitions and abbreviations in the scoring should be uniform in the various criteria documents.

## 4. Sanitary cleaner 1994 - 1999, Version 1.2

### *Environmental Aspects*

The criteria document contains no LCA considerations and this is motivated by the lack of a generally accepted method for complete LCAs. This is also the motivation given to explain why the evaluation of the environmental impact of the products is limited to the potential effects of the products and that of the packaging.

This is one of the few documents concerning the use of surface active agents that mentions the importance of the four factors that influence the cleaning procedure, namely, the input of mechanical energy (1), time (2), temperature (3) and chemical (4). It is stressed that 1, 2 and 4 are the most important in the product group. However, no further assessment is given or mentioned. This should be part of an LCA approach

The lack of life cycle considerations is in contradiction to the intentions and recommendations of NMR.

### *Quality and Performance Requirements*

The concept of quality or functionality is mentioned in the document but no test method is recommended. The document states that test methods and test results should be documented.

### *Definition of Product Group*

The product group and the ingredients are described clearly.

### *Level of Requirements/Choice of quantitative criteria*

The document does not contain any calculation matrix for scoring the products. This document is one of the few that mentions future EU directives, however without any reference. The document limits the use of environmentally hazard labelled substances to a maximum of 2 % totally in the product according to EU directive (67/548/EEC). No background information is given for this limitation.

The criteria document limits the content of readily degradable surfactant to 3%, the NTA to 10% and phosphorus to 0.5 (liquid) and 2.5% (solid). No background data or information for these values is given in the document. It is confusing that NTA is permitted in certain products and prohibited in other documents without any explanation.

Risk assessment of single ingredients is possible in the product group. This is however not used in this criteria document.

An outline for risk assessment is given in the comment to the criteria for Household detergents

## 5. Dishwashing detergent 1997-2001 Version 2.0

### *Environmental Aspects*

The criteria document does not include a full LCA view of the products. It is, however, stressed that the energy use in the dishwashing process is one of the most significant pollution factors.

The ingredients in dishwashing detergents are well-known chemicals in an LCA context and the energy use conditions have also been studied extensively in the dishwashing process. It should not be too complicated to perform an LCA and include its result in the scoring of dishwashing agents.

It is stressed that the future document will include the entire life cycle of the product.

The general description of the environmental effects is correct and it also includes a discussion of the energy use in the dishing process as a main source of environmental impacts.

The parameters used in the criteria document do not reflect all major environmental impacts during the life cycle of the product. They are focused on the inherent environmental properties of chemicals in the product.

In order to be able to distinguish between the various products from the environmental point of view, it would be necessary to introduce criteria for optimum energy use in the use phase of the life cycle of the product.

### *Quality and Performance Requirements*

The Quality and Performance Requirements are mentioned in the document and a standardised test method is recommended for determining the dishwashing efficiency. The reference dishwasher in the method contains sodium dichloro isocyanurate, which is prohibited in eco-labelled products.

The efficiency is however not included in the scoring of the products.

### *Definition of Product Group*

The product group and the ingredients are described clearly.

### *Level of Requirements/Choice of quantitative criteria*

The quantitative criteria given in the document are based on the amount and kind of chemical substances in the products, related to the recommended dosage of detergent. Though these criteria concern the limitation of use and discharge of organic and inorganic chemicals with potentially adverse environmental properties. Three of the environmental targets given by the Swedish EPA are affected, namely

The discharge of POP (degradation products of certain surfactants).

Eutrofication by limiting the use of phosphorus.

The fate of metals in the environment by limitation of the use of certain chelators.

One of the environmental targets of the Swedish EPA, the discharge of climate effecting gases, is not affected by the criteria, although one major environmental impact during the life cycle of the product comes from the energy used in the use-phase.

The demands of the criteria document are based on the content of dishwashing detergent and based on the inherent environmental properties of the ingredients. Many of the ingredients are influenced by use, by rapid degradation, transformation or reaction processes (with other ingredients in the detergent) processes before discharge. The inherent properties of these chemicals are not necessarily existent upon discharge.

The ingredients in the dishwashing detergents are well-established chemicals and regular risk assessment could be performed in order to evaluate the risks associated with the products.

The outline of the risk assessment procedure has been described in the comments for Household detergents.

#### Requirement on specific ingredients

The limits of hazard labelled ingredients may not exceed 0.4 g/dish for ingredients classified as R50/R53 or R52/R53 and 0.05 g/dish for ingredients classified as R50/53. Ingredients classified as R50 and without any other labelling may not exceed 2.0 g/dish. How these limits are established is not given in the document.

#### Calculation matrix

The scoring is composed of the addition of 6 different factors: the total amount of chemicals per dish (K), toxicity and degradability (GN), phosphorus content (P), not ultimately biodegradable organic compounds (IFN), not anaerobically biodegradable organic compounds (IAN) and the packaging (VNF).

The calculation of the contribution of GN to the scoring is based on the summation of factors, amongst others TOX<sub>i</sub> for single ingredients. This is not a scientific approach, because toxicity of single ingredients is usually not additive. According to the proposal concerning preparations (products containing more than 1 component), 96/C 283/01: *"Where laboratory tests are conducted, they must be carried out on the preparation as placed on the market"*. The ecotoxic properties of the entire product should be used in the scoring.

## **6. All purpose cleaner 1995-1998 Version 1.3**

### *Environmental Aspects*

The criteria document does not include any for of life cycle assessment of the products and this is also mentioned. A LCA would probably be quite difficult to conduct due to the use pattern of the product group. However, life-cycle studies have been performed for certain product types (see Kuta, C. E, et al., Resources, Conservation and Recycling, 14 (1995) 185-198). These studies have identified energy related emissions as dominant contributors to the overall environmental impacts..

Thus, one major environmental impact of the product group seems to be related to the energy use and the criteria document deals only with the chemical ingredients and packaging of the products. These parameters do not reflect all the major environmental impacts.

### *Quality and Performance Requirements*

The criteria document mentions that the efficiency of the product, proved by efficiency or consumers testing, should be comparable with existing products. However, there is no recommendation for testing. It is envisaged that future criteria document will include such a test method.

### *Definition of Product Group*

The Definition of the Product Group and its possible ingredients are well described.

### *Level of Requirements/Choice of quantitative criteria*

The limits for environmentally hazard labelled substance according to the 18th amendment of 67/548/EEC may not exceed 1% for single ingredients and 2% totally. The origins of these limits are not given in the document.

The criterion for ecotoxicity of surface-active ingredients is given as a dilution index (or toxic unit) based on the content of the surface-active ingredient in the diluted product and the ecotoxicity of the component (highest acute toxicity value). The dilution index should be less than 200. The dilution index is calculated for each component and these are added for the different ingredients used.

This is against a scientific approach, because as mentioned previously, toxicity's are not additive.

The criteria do not contain any risk assessment as described in the comments for Household detergents.

The described evaluation for single ingredients, is a common method for simple effect assessment. Safety factors of 10, 100 and 1000 are used to assess the need for dilution, depending on the number of tested species. If only 1 acute toxicity value is available, the safety factor is the highest for assessing a no observed effect concentration (NOEC) in the receiving water. The safety factor is 10 when at least 3 species are tested concerning the lowest observed effect concentration (LOEC) and the highest toxicity value (most sensible organism) is used in the assessment.

The toxicity however is an inherent property, which in combination with the criteria of the use of only readily degradable surface-active agents, is a less important property. The toxicity is already eliminated at the loss of surface activity, which is the first step in the degradation process.

The content of phosphorus containing ingredients is limited to 0.2% for liquid and 2.5% for solid products. The limit values are not motivated in the document.

Both NTA (5%) and EDTA (0,1%) are permitted in these products. There is no motivation for these limit values and recent investigation of the degradability of EDTA in biological treatment is not considered.

In spite of the attempt towards an effect assessment in the document, it would be desirable to have a complete risk assessment of the ingredients used in the products. Most of the ingredients and their use are well known and the prediction of the environmental concentration (PEC), locally or globally, is possible. The availability of environmental data is good and prediction of the no effect concentration PNEC is possible by using the same type of evaluation as the criteria document uses in a very simple manner.

## **7. Detergents for manual dishwashing 1996-1999, Version 1,1**

### *Environmental Aspects*

The criteria document does not mention or contain LCA considerations. This is in contradiction with the intentions of the NMR.

It is mentioned, however, that it is difficult to estimate the environmental load for the raw materials in the product group. Because of the similarity of the raw material in the products, the contribution of environmental load from these is also similar and would not influence the LCA evaluation of different products. The criterion for the product group is therefor based on the properties of the ingredients.

An LCA, which include the use of the products, is probably very complicated because of difficulties in defining conditions during the manual dish washing process. However, there is a possibility of using the procedure conditions as described in the determination of the functional dose of the products (see below).

The criteria document states that the environmental impacts of the products are mainly connected to the emissions to water after use. This is probably not correct because the energy uses during the use phase in form of heating water should give substantial contributions to the impacts.

As the parameter in the criteria addresses only the inherent environmental properties and the amount of chemicals used, the criteria do not reflect all the major environmental impacts.

### *Quality and Performance Requirements*

The criteria document recommends two unofficial test methods for establishing the functional dish washing dose. The functional dose is used in the calculation of various scores of the products. This is an indirect measure of the quality of the product.

### *Definition of Product Group*

The definition of product group and its ingredients is well described.

### *Level of Requirements/Choice of quantitative criteria*

#### Requirements on specific ingredients

The numeric limits for hazard labelled ingredients (R50+53, R51+53 and R52+53) at 0.015 g/functional dose is not motivated in the document. The limit for R50 labelled ingredients are higher, 0,6 g/functional dose, and this is not motivated either. It reflects a certain consideration concerning the relationship between acute toxicity and readily

biodegradable surface-active agents.

No background data are given for the limitation of NTA (0,015 g/functional dose). NTA is biodegradable according to OECD 303, i.e. the simulation test for sewage treatment plant after adaptation. Recent research gave similar results for EDTA.

#### Calculation matrix

The scheme in the scoring matrix includes the amount of product, a toxicity score, not anaerobically biodegradable ingredients and the packaging, all related to the functional dose. The numeric values of the constants are not described in the text.

The toxicity evaluation is based on the inherent properties of single ingredients, however, the degradability of the ingredients is considered by using different weighting factors. The toxicity scores for each component are added, but this is against a scientific approach, as toxicity's are not additive.

No risk assessment (RA) of the ingredients has been performed.

It is questionable whether the soluble inorganic component(s) in this type of product should be a part of the toxicity score even if its contribution to the total score is low.

## **8. Film forming floor polish and wax 1996 - 1999 Version 1.0**

### *Environmental Aspects*

The Environmental Aspects of the product group is described clearly. The products enter, after treatment, the environment into water or soil in connection with cleaning or dewaxing the floor. It is stressed that the product group should contain only small amounts of hazardous ingredients (inherent properties).

An LCA approach is mentioned implicitly, but no evaluation of the products is performed.

The lack of life cycle considerations is in contradiction to the intentions of the NMR.

The document stresses that the products in the group contain similar ingredients and the resource use at the production should also be similar. The evaluation of resource use at production of raw materials is therefore omitted.

The criteria concerning the chemicals in the floor products probably reflect the major environmental impact of the product although the final emissions are treatable in treatment plants.

### *Quality and Performance Requirements*

The Quality and Performance Requirements of the product must be documented with results obtained from the recommended test methods given in the document. The products must fulfil certain quality criteria according to the tests.

### *Definition of Product Group*

The product group and its ingredients are well described in the document.

### *Level of Requirements*

The limit for environmentally hazardous ingredients is 50 mg/g active content for single ingredients and 100 mg/g active content in total. There is no background data in the document supporting these limits.

The hazard labelling of the ingredients are based on inherent properties and no evaluation of the alteration of these properties during use and treatment is considered.

The products in the group contain a number of polymeric ingredients, polymers, waxes, resins, which are more or less persistent and hazardous. These ingredients are however effectively separated from the cleaning and dewaxing wastewater.

The limitation of NTA at 50 mg/g active content is not motivated. NTA is biodegradable under sewage treatment conditions.

The toxicity evaluation of surface active agents are based on the critical dilution volume (CDV) calculated as the ratio between the amount of a single surface active agent per litre diluted product and the acute toxicity of the surfactant. The sum of CDV for surfactants should be less than 200.

The CDV calculation for single ingredients is an accepted, although simplistic effect assessment. The summing of CDs is on the other hand contrary to scientific principles because toxic properties are often not additive. Toxicity can decrease, be eliminated or even increase by mixing different surface-active ingredients. CDV should be calculated from the toxicity of the mixture.

## Conclusions

The detailed requirements differ in the various criteria documents. Common aspects for several criteria are described below:

### *Environmental Aspects*

According to the recommendations from NMR, the environmental effects of the product throughout its entire life cycle shall be defined and used as basis for the choice of a limited number of parameters. Environmental principles such as the precautionary and substitution principle should be included in the development of the criteria.

### Life cycle perspective

None of the criteria documents define the environmental effects throughout the life cycle of the products; e.g. life-cycle considerations are not documented.

Consequently, the choice of parameters in the criteria documents is not based on an evaluation of all the major environmental impact of the products during their life cycles. According to many LCA studies, these are dominated by the use phase (i.e. dosage and temperature concerning detergents), that implies that product efficiency in many cases is the most important property from the environmental point of view. The environmental soundness of some products is almost entirely dependent of the efficiency of the product. This is not considered at all in the criteria.

None of the criteria documents refer to LCA studies or life-cycle considerations for the various products and this is motivated by the lack of data, the lack of knowledge or by the diversity of the product category. However, life-cycle considerations do not necessarily require a fully detailed quantitative LCA.

There are now LCA studies available for household detergents, shampoo, etc., which can be used in future criteria documents.

The lack of life-cycle considerations in the criteria documents is in contradiction to the intentions and recommendations of NMR.

### Precautionary and substitution principle

The precautionary principle is reflected in all criteria document but it is based on the hazardous inherent properties of the ingredients in various product groups. No risk assessment is performed.

The criterion for eco-labelling is based on the environmental impact of the products and that of the packaging of the product. However, the criteria are based on inherent environmental **properties** of the product and that of the packaging. The inherent environmental properties of chemicals characterise the **hazard** or the inherent possibility of a chemical to harm the environment. Emissions of hazardous chemicals can turn into a **risk** in the environment if the environment is exposed to high enough concentrations of the chemicals.

A risk assessment consists of an exposure assessment, an effect assessment (based on inherent properties) and a risk characterisation.

In the **exposure assessment** the concentration of the chemical in the environment is predicted (predicted environmental concentration, **PEC**). Typical data necessary for the exposure assessment are the amount used (per year), the usage pattern, the biodegradability and the dilution factor. The exposure is calculated locally, regionally or for greater area.

The **effect assessment** is based on the inherent properties of the chemical. Ecotoxicity data on the acute and/or chronic level (for instance long-term toxicity, reproduction, etc.) is needed. A predicted no effect level concentration, **PNEC**, is estimated from the available ecotoxicity data by using division with safety factors of 1000 (single species, acute toxicity) and down to 10 (most sensitive species, chronic level).

The **risk characterisation** ratio is calculated as **PEC/PNEC**. If the ratio is less than 1, there is no immediate concern for environmental effects. If the ratio is higher than 1, this indicates the need for risk management measures, such as limitation or omission the use of the chemical.

The possibility of persistent (not biodegradable) transformation products and bioaccumulation properties must be included in the evaluation of chemicals.

Many industrially used and product related chemicals have been evaluated in these internationally accepted schemes for risk assessment (by EU, KEMI in Sweden, etc.).

### *Level of Requirements/Choice of quantitative criteria*

The requirements in the criteria documents are based on inherent environmental properties of product ingredients.

Hazard assessment based on inherent properties of single chemicals is optional in eco-labelling but does not in any way assess formulated products. The available scoring methods are not considered robust. A chosen single scoring method may offer comparability, but it may lead to wrong conclusions (contraproductive conclusions) if used as an absolute quantitative score (hurdle criteria) in eco-labelling. Available quantitative methods may possibly be used to rank individual substances and thus identify candidates for regulations.

An extended hazard assessment also including generic exposure analysis based on model assumptions, i.e. a model of the Baltic Sea is in principle also optional in eco-labelling. It does not address actual effects but only potential effects associated with single substances. Products can therefore not be evaluated. However, this is still an uncertain approach, since available quantitative methods suffer from major data gaps. It is for that reason not yet considered robust enough in conventional LCA.

Site specific risk assessment, which may address actual effects is not optional in eco-labelling, since geographical differentiation is not allowed for obvious reasons.

The above mentioned limitations are however inherent limitations in all ecolabelling programmes of this type.

### Specific limitations

The criteria documents include limitations of certain ingredients like, chlorine compounds, EDTA, optical brighteners, etc.

Uniformity amongst the various documents would be desirable. Some ingredients are allowed in some criteria but not in others. One example is NTA.

Three of the environmental targets defined by the Swedish EPA are reflected by the requirements:

- The discharge of persistent organic substances (POP), by limiting the use of partially degradable surfactants (aerobically and anaerobically) such as NPE, etc.
- The eutrofication by limiting the use of phosphorus.
- The fate of metals in the environment by limiting the use of complexing agents such as EDTA or phosphonate.

However, no criteria parameter in the eco-labelling documents addresses emissions of gases from energy use contributing to global warming, which probably are dominant contributors to one major environmental impact in the life cycle of most product groups. These may not be appropriate parameters in a Nordic ecolabelling scheme, since the generation of, i.e. electricity is based on quite different processes in the Nordic countries, but energy use should be a neutral parameter.

The specific requirements for the total amount of ingredients classified for human and environmental safety are also limited in the criteria documents. There are no background data how these limits are set and the way of expressing a sum of hazardous dose is contradicting scientific evaluation.

### Calculation matrix

The evaluation matrix for scoring includes a number of parameters such as total quantity of chemicals, toxicity and biodegradability, phosphorus content, inherent biodegradability, anaerobic degradability, organic content, content of soluble and poorly soluble inorganic compounds and the weight of packaging.

#### *Total quantity of chemicals*

This part of the scoring matrix is important as it is an essential factor for the use phase (major environmental impact according to LCA studies) of the products and regulate the distribution of energy use amongst chemical/temperature/mechanical work and time for the cleaning process. The more effective the detergent mixture is the better resource use is obtained in the cleaning process.

#### *Toxicity and biodegradability (GN, CDV)*

The toxicity and degradability have highest priority in the scoring matrix. The toxicity and biodegradability are calculated in various ways: sometimes the GN is calculated for the total amount of product used in the cleaning process while in other cases it is related to the active ingredients of the product. A more uniform way of calculations would be advisable. CDV is a different way of evaluation of the toxicity and biodegradability; it vaguely resembles a kind of risk assessment.

However, both are calculated by addition of numerical values for every component in the product. This is scientifically not plausible, because toxicity of single substances is not additive.

The importance of toxicity and degradability is of course high especially at direct discharge. The current high priority of ecotoxicity is questionable in the light of that most of the surfactants used today are ready biodegradable and treatable in municipal sewage treatment. In addition, the toxicity of surfactants is an inherent property that is

reduced or eliminated upon primary degradation.

The numeric addition of various properties and amounts is a quantitative hurdle that is scientifically not justified.

The parameters in the scoring are not chosen to secure the functionality and efficiency of the products, which as mentioned before is the most important factor influencing the environmental impact of a product.

#### *Quality and Performance Requirements*

Functionality tests are defined for all criteria except for shampoos and soaps, sanitary cleaners and all-purpose cleaner. The only document where the result of the test is included in the scoring is for manual dish washing agents.

The performance of the various product groups is of importance because according to existing LCA studies the major environmental impact is in the usage phase of the products where the efficiency of the product is of great importance (dosage and temperature). The efficiency of the various products should be reflected in the evaluation of the products.

#### *Definition of the product group*

This is well described in all criteria documents.

## **Summary of Conclusions**

### **Fulfilment of the Intention of the NMR**

- The intentions of NMR are not fulfilled in regard to the use of a life-cycle approach for defining the most important environmental impacts and as basis for the choice of scoring parameter in the criteria.
- The precautionary principle is reflected in all the criteria documents but it is based only on the hazardous properties of the ingredients in various product groups. No complete risk assessment of the individual product ingredients has been performed. The substitution principle is also a part of the criteria documents but no consequence evaluations are performed.

### **Scientific Evaluations of Parameters for Assessment of Products**

- The calculation of ecotoxicity used for the scoring of products does not follow scientific principles, as the toxicity's of single compounds are not usually additive.
- No motivation or background data is given for the specified limits of single ingredients.
- A uniform assessment of specific ingredients is desirable the different criteria.
- The choice of parameters does not reflect all the major environmental impact during the products life cycle, for example energy use.



---

**IVL Svenska Miljöinstitutet AB**

Box 210 60, SE-100 31 Stockholm  
Hälsingegatan 43, Stockholm  
Tel: +46 8 598 563 00  
Fax: +46 8 598 563 90

[www.ivl.se](http://www.ivl.se)

**IVL Swedish Environmental Research Institute Ltd**

Box 470 86, SE-402 58 Göteborg  
Dagjänningsgatan 1, Göteborg  
Tel: +46 31 725 62 00  
Fax: +46 31 725 62 90

Aneboda, SE-360 30 Lammhult  
Aneboda, Lammhult  
Tel: +46 472 26 20 75  
Fax: +46 472 26 20 04