EUROPEAN COMMISSION
HEALTH & CONSUMER PROTECTION DIRECTORATE-GENERAL

Directorate C - Public Health and Risk Assessment
C7 - Risk assessment

SCIENTIFIC COMMITTEE ON HEALTH AND ENVIRONMENTAL RISKS

SCHER

Opinion on

"Environmental Risk Assessment of non Biodegradable Detergent Surfactants under Anaerobic Condition"

Adopted by the SCHER during the 8th plenary meeting of 25 November 2005

TABLE OF CONTENTS

1. BACKGROUND

As part of the modernisation of the legislation on detergents, the Commission contracted the Fraunhofer Institute für Umwelt-, Sicherheits- und Energietechnik to assess the environmental impact resulting from the incomplete biodegradation of detergent surfactants under anaerobic conditions. This report was completed in 2003 and covers eighteen Member States of the European Union including Poland, Hungary, and Czech Republic.

In parallel, AISE (International Association for Soaps, Detergents and Maintenance Products) and CEFIC - ECOSOL (European Chemical Industry Council - European Centre of Studies on LAB/LAS) have carried out a risk assessment on linear alkyl benzene sulfonate (LAS). A first mandate based on these two reports was submitted to the SCHER for opinion in 2004.

Recently, the OECD published an in-depth review of the (eco) toxicological hazards of linear alkyl benzene sulfonate. This study has been carried out within the framework of the "high production volume chemicals (HPV)" under the umbrella of the International Council of Chemical Associations (ICCA).

Another report related to the environmental LAS-based risks has been recently carried out by the JRC.

A second mandate for opinion requesting the inclusion of these two new reports was submitted to the SCHER in May 2005.

The documents submitted to SCHER are:

- Fraunhofer (Anaerobic biodegradation of detergent surfactants, Final report - 2003), covering several surfactant groups
- HERA report (Human and Environmental Risk Assessment of Linear Alkylbenzene sulphonate – 2004), covering exclusively LAS
- OECD report (Linear Alkylbenzene sulphonate, 2005), covering exclusively LAS
- JRC Report (Evaluation of the relevance of organic micro-pollutants in sewage sludge - 2004), covering LAS and NP

As agreed between the SCHER and the Commission the two mandates related to the potential environmental impact of anaerobically non biodegradable surfactants have been merged and reformulated as follows:

2. TERMS OF REFERENCE

1) The SCHER is requested to assess the overall scientific quality of the Fraunhofer report and to comment in particular on its completeness and reliability, and on the validity of its conclusions.

2) The Committee is requested to express an opinion on the following specific issues, taking account of additional documentation that has been transmitted to the SCHER:

a. What is the nature and magnitude of the risk to the environment currently posed by detergent surfactants that are poorly biodegradable under anaerobic conditions, but which are readily and ultimately biodegradable under aerobic conditions?

b. What impact would full implementation of the Urban Wastewater Treatment Directive have on the above risk given that this Directive aims at improving the treatment of sewage effluents in order to limit environmental damage of pollutants?

c. What impact would the introduction, in conjunction with the above, of a requirement for ready and ultimate biodegradability of surfactants under both aerobic and anaerobic conditions have on the above risk?

d. Does the Committee agree with recommendations in the report concerning the test methods for the anaerobic biodegradation of detergent surfactants, in particular that a method based on ISO 14853 is the most satisfactory and that a pass threshold of 60% is appropriate?

3) The Committee is requested to express an opinion specifically on LAS-related issues taking account of the additional documentation that has been transmitted to the SCHER Committee.

a. What is the nature and magnitude of the risk to the environment currently posed by LAS?

b. Does the HERA report constitute an accurate and reliable Risk Assessment on LAS and is consistent with the Fraunhofer report?

c. Is an upper limit for the application rate of LAS in sewage sludge justified on the basis of environmental risk?

3. OPINION

3.1. Opinion on the overall scientific quality of the Fraunhofer report: completeness, reliability, and validity of its conclusions.

The study prepared by the Fraunhofer Institute (UMSICHT), organised in 20 chapters, covers a survey of statistical data on detergent production and consumption in Europe (15 Member States), the Eco-labelling systems, the concentration and biodegradation of surfactants in different environments, the evaluation of the effects (toxicity, ecotoxicity and bioaccumulation). The alternatives for reduction of surfactant concentrations are considered along with the biodegradability tests under anaerobic conditions. Finally, the report includes a set of recommendations for test methods and for cost/effective measures for measuring the anaerobic biodegradability of surfactants. Definitions, methodology used for the data research, 492 bibliographic references ranging from 1956 to 2002, and the list of abbreviations are included.

The report is marred by the following:

- Some data are old and available literature data or information is lacking.

- The quality of the different chapters is variable and the data collected are not exhaustive for some chapters of the report.

- There are some flaws in the analysis and conclusions drawn from it in the effects assessment. These will be dealt with below.

(a) Surfactant consumption and production

There is a lack of recent data referred in Table 9.1 (countries profiles), and for some countries there are no data at all. There is also some discrepancy between the list of laundry detergents based on 1990-2000 data, and the list of surfactants consumption provides data up to 1995.

(b) ***Surfactant concentrations in different environmental compartments.***

The report offers a significant amount of monitoring data for effluents, sludge, receiving aquatic systems and soil. Aerobic degradation is essential for the degradation/dissipation of surfactants in the WWTP. However, the anaerobic degradation of surfactants seems to play no role in the WWTP effluent concentrations. In fact, the reduction observed between the inflow and outflow concentrations of LAS seems to be higher than that observed for anaerobically degraded non-ionic surfactants. For sludge, most information covers LAS and indicates that concentrations in anaerobically treated sludge are about one order of magnitude higher than those in aerobically treated sludge. Nevertheless, the concentration of anaerobically degradable surfactants in the sludge is not negligible, and although the information is much more limited, reported concentrations for APE and AE are in the range of 500-1000 mg/kg dw.

For the terrestrial compartment a rapid degradation of LAS in soil after the application of sludge has been demonstrated in laboratory and field experiments. The degradation seems to follow first order kinetics, with most half-lives <30 days, even for very high initial application concentration. No information on the degradation of APE and AE in soils is presented.

The chapter also includes conclusions on the risk characterization which cannot be evaluated by the SCHER due to the uncertainty in the effect assessment part (see comments in the following paragraph).

(c) Effects of surfactants

The strong inhibitory effects of LAS on the metabolic activity of autotrophic ammonia-oxidizing bacteria have not been discussed in depth with respect to the importance of this nitrogen-cycling reaction in soils and waters. In addition the possible enhancement of heavy metals uptake by crops, due to the presence of LAS in sewage sludge, is not sufficiently discussed in the report.

(d) Assessment of effects

The effect assessment provided in the report is weak and unacceptable. Some aspects suggest an insufficient knowledge of ecotoxicology and its use in environmental risk assessment.

The PNECs employed in the report are basically taken from other reports; PNECs have been derived using deterministic methods in some cases and probabilistic methods in others. Unfortunately, the report does not include enough information on the criteria employed for the derivation of each PNEC. The SCHER considers that the minimum level of information required for presenting a PNEC derivation using deterministic approaches should include the taxonomic

groups covered, the measured endpoints, the lowest valid value employed for the derivation, the application factor and the criteria for setting the data quality.

Similarly, for the derivation of a probabilistic PNEC the information should include the taxonomic groups covered in the assessment, the fitting methodology if any, the selected probability endpoint (e.g. the x^{th} percentile or the y^{th} confidence interval around the x^{th} percentile), and the justification for uncertainty factors if used. Several of the above mentioned criteria are not fulfilled in the Fraunhofer's report.

These minimum requirements are not fulfilled. As a consequence, the SCHER concludes that the Fraunhofer´s report does not include enough information for allowing the Committee to agree on the proposed PNECs values.

(e) Other comments and need for updating the information

- *LAS biodegradation under anaerobic conditions: new insights*

Recent papers (Angeladaki et al., 2004; Lobner et al., 2005; Mogensen et al., 2003) reported on the possible anaerobic degradation of LAS under methanogenic conditions. The experiments were performed mainly with UASB reactors operating either in mesophilic (37 ºC) or in termophilic (55 ºC) conditions. Removal of 40 to 80 % of the initial LAS concentration was reported. Doubts remain however, about the actual abatement of LAS through biological reactions under anaerobic conditions.

Anaerobic biodegradability of LAS should be tested and assessed in a wider spectrum of anoxic microbial ecosystems. More information is needed on anaerobic biodegradation of LAS under conditions different from the methanogenic ones. For instance, microbial degradation in the presence of final electron acceptors such as nitrates (denitrification) should be investigated as these conditions can be considered as frequently occurring in wastewater treatment processes.

- *LAS induced inhibition of autotrophic nitrification in soil*

More detailed information is needed on the inhibition of nitrogen-cycling in soils and waters, taking into account that autotrophic ammonia-oxidising bacteria represent a sensitive indicator for risk assessment at site-specific level (Nielsen et al., 2004).

- *LAS in marine aerosol: magnification of toxic effects of pollutants on plants*

Biodegradation of linear alkyl benzene sulfonates and sulphophenylcarboxylic acid intermediates has been shown to exceed 99% in tests performed in seawater (Leon et al., 2004). Nevertheless, since the kinetic of degradation of LAS in seawater presents a clear seasonal component, with the process considerably inhibited at lower temperatures, aerosol transported during storms in the winter might lead to LAS to concentrations harmful to coastal vegetation.

(f) Conclusions of the Fraunhofer report

The report's conclusions are presented in text format and the SCHER would appreciate much clearer, and possibly quantitative, conclusion statements. The Committee agrees with the following statements presented in the executive summary:

- *Data highlight that a remarkable variability in the types of detergent surfactants can be found in detergents intended for a similar purpose. This is partly due to the diversity in washing machine technology, distinct regional habits for fabric use and care, variability of water hardness throughout the EU, etc.*

- *It seems that the higher concentrations of surfactant in surface water are associated with poorly treated or untreated sewage, directly discharged to rivers.*

- *The poor biodegradability of some surfactants (e.g. LAS) under anaerobic condition may sometimes result in a high surfactant sludge load, especially after treatment of sewage in WWTP employing an anaerobic sludge stabilisation process. When the anaerobically treated sludge is used as fertiliser in agriculture, the surfactant concentration in sludge-amended soil is predicted to decrease rapidly because of the aerobic biodegradation process occurring in soil.*

  Regarding this conclusion the SCHER would like to highlight that although the concentration of anaerobically degraded surfactants in sludge treated by anaerobic processes is lower than that obtained for non anaerobically degradable surfactants, it is still very high. It cannot be assumed that the risk for soil systems of anaerobically degradable surfactants is negligible. A proper risk assessment considering the environmental fate and ecotoxicological profile of the surfactants is required.

- *Overall, the data analysis confirms that all surfactants must be ultimately and readily biodegradable under aerobic condition in order to prevent major environmental impact.*

- *With regard to sediments, no accumulation of aerobically ready biodegradable surfactants has been observed, in particular for LAS even over a period of several decades. This seems to confirm that aerobic biodegradation plays the main role in elimination of organic compound.*

- *Various sources report that coastal forests in Mediterranean areas have been deteriorating since the 1960s. The damage is usually attributed to a combined effect of sea spray containing salt and pollutants like synthetic surfactants or oil. Nevertheless, the report outlines that not only one type of surfactant – LAS is usually implicated for example – is responsible for this effect but other pollutants may also be involved (ozone, poly aromatic hydrocarbons, phthalates, n-alkanes, etc). Some recent data indicate that an improvement of the coastal vegetation (in Spain) is observed in areas where wastewater is adequately treated by WWTP. A confirmation of these results by other studies would be useful to substantiate the general validity of this statement.*

The SCHER disagrees with the following conclusions from the report:

- *Data show that the anionic surfactant concentrations are low in surface water and are similar in all countries.*

  The SCHER considers that the reported information (qualitative and quantitative) is not sufficient for supporting this conclusion. Some differences among countries and within countries are reported, but it is not possible to establish conclusions on inter-country variability as the characteristics and robustness of the different monitoring programmes have not been properly reported.

- *Effluents from WWTP do not in general increase the surfactant concentration in receiving rivers.*

  The Committee's evaluation of the specific monitoring programmes mentioned in the report clearly indicates that increases in surfactant concentrations downstream from WWTP are, as expected, consistently higher than those measured upstream. However, SCHER does support the conclusion that, based on the large amount of information available for LAS, the concentrations measured downstream of a properly-working WWTP are below the PNEC proposed in the HERA report and supported by SCHER after the evaluation of the OECD reports, and therefore represent a low risk for aquatic organisms (see answer to question 3 for additional information). The conclusion is also suggested in the HERA and OECD reports.

- *No accumulation of the measured surfactants (mainly LAS, NP and derivatives, AE, DTDMAC/DSDMAC) has been observed in the water bodies. With regard to LAS, available data suggest that there is no enrichment of LAS in the freshwater environment over a period of several decades even though this substance has been used in large amounts and is not biodegradable under anaerobic condition.*

  The amount of information reported, particularly for surfactants other than LAS, is not sufficient for supporting this conclusion. Most measured freshwater systems are "running-water" bodies and therefore, long-term accumulation requires very specific targeted programmes not covered by the "standard" and/or sporadic measurements reported in the document. As expected, ultimate ready biodegradation is an indication of low environmental persistency, and therefore, this conclusion can be expected from the analysis of the information on LAS and other readily biodegradable surfactants, but it is not really proven by the reported data.

3.2. Opinion on the following specific issues, taking account of additional documentation that has been transmitted to the SCHER Committee:

3.2.1 Question 2a)

What is the nature and magnitude of the risk to the environment currently posed by detergent surfactants that are poorly biodegradable under anaerobic conditions, but which are readily and ultimately biodegradable under aerobic conditions?

Answer

A poor biodegradability under anaerobic conditions for detergent surfactants is expected to increase the potential for exposure of soil organisms due to the use of anaerobically stabilised sewage sludge as fertilizer in agriculture. However, as environmental release is just part of the risk assessment, the environmental fate and behaviour and the toxicity of each surfactant should be considered for addressing the consequences on the overall risk. A poor biodegradability under anaerobic conditions is not expected to produce substantial modifications in the risk for freshwater ecosystems as the surfactant removal in the WWTP seems to be regulated by its aerobic biodegradability.

Regarding the magnitude of the risk, the opinion on the environmental risk of LAS is presented below. For other surfactants, the Fraunhofer´s report does not include enough information for allowing the Committee to agree with the proposed effect assessment values, and, therefore, the SCHER cannot produce an opinion on their actual risk.

3.2.2 Question 2b)

What impact would full implementation of the Urban Wastewater Treatment Directive have on the above risk given that this Directive aims at improving the treatment of sewage effluents in order to limit environmental damage of pollutants, such as LAS?

Answer

The Urban Wastewater Treatment Directive requires the implementation, within specified timeframes, of different levels of wastewater treatment related to the population served by the WWTP facility. The risk assessments conducted in the documents submitted to the SCHER are based on the assumption that effluents are treated through a "generic" wastewater facility before reaching surface waters. This is also the assumption in the TGD for all risk assessments. Therefore, the SCHER does not have information on expected PECs for the different treatment requirements considered in the Directive, and therefore cannot quantify the impact of the implementation of this Directive.

3.2.3 Question 2c)

What impact would the introduction, in conjunction with the question above, of a requirement for ready and ultimate biodegradability of surfactants under both aerobic and anaerobic conditions have on the above risk?

Answer

A ready ultimate aerobic biodegradability ensures that surfactants, which are mostly released into the environment by the wastewater and sewage sludge pathways, are rapidly degraded in a predominantly aerobic environment.

There is evidence indicating that fulfilling the criteria for ready and ultimate aerobic biodegradability is essential for achieving a significant dissipation/removal of surfactants in the WWTP, while anaerobic biodegradation plays a minor role in the overall dissipation/removal.

The information reviewed by the SCHER suggests that fulfilling the criteria for ultimate biodegradation under anaerobic conditions leads to a significant reduction in the surfactant sludge concentration in those cases where anaerobic sludge digestion process is included in the overall treatment. However, the measured concentrations of anaerobically degradable surfactants in sludge are still significant, and therefore, in the opinion of the SCHER, the potential environmental risk associated to the presence of surfactants in sludge intended to be used as fertilizer in soil should be assessed even for surfactants fulfilling the anaerobic biodegradation criteria.

As a consequence, the requirement for ready an ultimate biodegradability under anaerobic conditions is not considered an effective measure for environmental protection.

3.2.4 Question 2d)

Does the Committee agree with the recommendations in the report concerning the test methods for the anaerobic biodegradation of detergent surfactants, in particular that a method based on ISO 14583 is the most satisfactory and that a pass threshold of 60 % is appropriate?

Answer

No evidence is given that ISO 14853 was a more predictive method than other standardised test methods for evaluating anaerobic biodegradation of detergent surfactants. Actually, testing conditions of ISO 14853 (1999) are very similar to those of other methods such as ISO 11734 (1995) and the ECETOC (1998) tests. Data on anaerobic biodegradability of 9 different surfactants discussed in the Fraunhofer report were obtained by applying the ISO 14853 test method. Biodegradation tests were performed at 100 mg C/L and 50 mg C/L surfactant concentrations. However, these initial surfactant concentrations in the standard test should be lowered to avoid potential inhibitory effects of the surfactant on the anaerobic microbial consortia.

In the last years, different test methods have been standardised to determine the biodegradability of organic compounds under anaerobic conditions based on the quantification of biogas produced as final product of the degradation process. However, while performing ultimate biodegradation tests, we have to consider that part of the test substance is transformed into new microbial biomass and will not be used to produce biogas. Based on mineralization rates obtained even for easily degradable compounds, the threshold limit has been fixed as 60 % of the initial concentration of the tested compound in these screening tests.

Recent studies (Strevett et al. 2002) have indicated that single tests for evaluating anaerobic biodegradation are not sufficient, and that a combination of different testing conditions would be more appropriate; e.g. tests covering a range of different electron acceptors should be considered.

3.3. Specific opinion on LAS-related issues taking account of the additional documentation that has been transmitted to the SCHER Committee.

3.3.1 Question 3 a)

What is the nature and magnitude of the risk to the environment currently posed by linear alkyl benzene sulfonate?

Answer

The available information collected from the different documents submitted to the SCHER was been review by the Committee.

The analysis of these data suggests that currently LAS poses a low risk for aquatic organisms if the urban effluents are treated in a properly working WWTP.

Regarding the risk for soil organisms associated to the use of sludge as fertilizer, the SCHER agrees with the PNEC value for soil organisms of 4.6 mg/kg proposed by the LAS HERA which is also used in the Fraunhofer report. This PNEC combined with the PEC derived following TGD procedures, can be used for setting the potential risk for soil organisms of LAS in sewage sludge to be used as fertiliser in agricultural soils.

Following the TGD scenario for agricultural soils the maximum concentration of LAS in sludge that satisfies the condition for PEC/PNEC ratio below 1 are about 7500, 4900 and 4350 mg LAS/kg sludge dw for DT50 values of 7, 21 and 30 days respectively.

The comparison of those values with those reported in the Fraunhofer report and in the more recent data included in the JRC report indicates low risk for sludge produced under aerobic

processes. The values are however within the range usually observed for WWTP sludge obtained from anaerobic digesters, indicating that if applied without an aerobic pre-treatment, the PEC/PNEC ratio of 1 can be exceeded in some cases. There is no enough information for a proper probabilistic assessment, but the average concentration of LAS obtained from all available information is around 6000 mg LAS/kg sludge dw. The JRC report mentioned a range for sludge obtained through anaerobic processes between 2000 and 18000 mg/kg dw, well consistent with this average. The OEDC Initial SIDS report suggest an average LAS concentration for sludge from aerobic digesters in the US of 10500 mg/kg dw.

The LAS HERA report using the TGD scenario estimates a local PEC soil of 5.6 mg/kg, slightly above the PNEC. The OECD Initial SIDS report indicates that soil concentrations immediately after the application are generally less than 15 mg/kg dw, corresponding to PEC soil values (30d time weighting averaged values) of 10.8, 9.5 and 4.79 mg/kg dw for dissipation half-lives of 30, 21 and 7 days respectively. The JRC report suggests “typical” values for sludge amended soils of 1-1.5 mg/kg dw and a highest initial soil value of 11.23 mg/kg corresponding to PEC soil values (30d time weighting averaged values) of 8.1, 7.1 and 3.6 mg/kg dw for dissipation half-lives of 30, 21 and 7. The HERA report presents measured values and uses for the risk assessment the highest measured value of 1.4 mg/kg.

A key element for refining the assessment is the biodegradation during sludge storage, transport and the waiting period (several months) before its application to soil. The HERA report suggests a 50% reduction but the SCHER does not have enough information for quantifying this contribution.

Considering the overall values a generic estimation of low risk for most applications of aerobic sludge and anaerobic sludge submitted to aerobic processes can be expected. For anaerobic sludge not submitted to aerobic processes, the real risk would depend on the initial LAS concentration in the sludge, the dissipation before the soil application and the soil degradation rate. Under extreme conditions (e.g. the sludge containing the highest reported LAS concentrations, with no dissipation before the application and a soil half-life of 30 days) a potential risk cannot be excluded. However, the SCHER does not have information for assessing if these hypothetical (worst) case conditions occur under standard sludge application practices. The field studies demonstrate a rapid dissipation even at very high application rates; as well as a recovery of the soil community. Therefore, the effects, if any, would be local and reversible within a short period.

The SCHER considers that the assumption of first order kinetics for longer periods is not acceptable as the DT50 values are clearly different between summer and winter. In addition, anaerobic conditions are expected in the bottom part of the arable soil core during winter time in large parts of Europe. However, no accumulations of LAS are expected from repeated annual applications under normal conditions, as the degradation of LAS during part of the year is considered enough for reducing LAS residues coming from previous applications. In addition, Jacobsen et al., (2004) have demonstrated, in a lysimeter study, low risk for groundwater contamination with LAS at concentrations much higher than the proposed PNEC. The risk for bioaccumulation is also low.

As a general recommendation, the SCHER should stress the need for a proper European scenario for assessing the risk of chemicals present in agricultural fertilizers. The assessment and default values employed in the TGD are very different from those employed for other chemicals that reach the soil through the same route, such as feed additives, pharmaceuticals and some biocides. Harmonized guidelines for assessing the risk of these substances for terrestrial systems and the indirect risk for humans exposed via the environment should be developed.

3.3.2 Question 3b)

Does the HERA report constitute an accurate and reliable risk assessment on LAS and is consistent with the Fraunhofer report?

Answer

In general the Committee accepts the risk characterisations and the conclusions presented in the HERA report. The PNEC of 0.27mg/l is derived from a NOEC based on critical assessment of a number of mesocosm studies with no further application factor. The OECD report confirms the validity of this value for covering fish populations. As mentioned above, it should be noted that the HERA report conclusions focus on actual risks using monitoring data, and that the conclusions cover "typical" assessments, non worst case.

Notwithstanding the problems with the Fraunhofer report noted above, there is consistency between the Fraunhofer and HERA reports in the basic information.

3.3.3. Question 3c)

Is an upper limit for the application rate of LAS in sewage sludge justified on the basis of environmental risk?

Answer

The establishment of an upper limit of LAS in sludge is a risk management decision where other aspects in addition to the scientific risk assessment, such as the cost/benefit analysis, should be considered. In addition, other alternatives should be evaluated. Therefore, the SCHER will not comment on the appropriateness of imposing such a limit; instead, the Committee will summarise the expected environmental consequences for setting such a limit.

The risk assessment has identified that in most cases, a low risk is expected. The combination of worst case assumptions may lead to a potential risk for soil organisms. The effects, if occurring, will be local and recoverable.

It is suggested to consider if this combination of worst case conditions are realistic under the standard sludge application practices used in the EU before considering the need for establishing an upper limit for the application rate of LAS-containing sewage sludge.

The SCHER is also concerned by the high measured levels of other surfactants in sewage sludge, including some groups of surfactants which are anaerobically biodegraded. The limited amount of information presented for APE and AE indicates measured concentrations in the range of 500-1000 mg/kg. However, as there is lack of information on the toxicity of these chemicals to soil organisms a risk assessment cannot be performed. The risk of NPE and NP has been discussed in previous opinions of the CSTEE and therefore these substances were not been assessed in the present opinion.

4. CONCLUSIONS

The following conclusions can be drawn in the present opinion:

- The overall scientific quality of the report prepared by the Institute Fraunhofer (UMSICHT) is rather poor and variable for the different chapters.

- The SCHER disagrees with conclusions concerning (a) the anionic surfactant concentrations in surface waters, (b) the surfactant concentration in effluents from WWTP vs. receiving rivers (c) the accumulation of surfactants other than LAS in water bodies.

- The poor biodegradability under anaerobic conditions for detergent surfactants is expected to increase the potential for exposure of soil organisms due to the use of anaerobically stabilised sewage sludge as fertilizer in agriculture. However, as environmental release is just part of the risk assessment, the environmental fate and behaviour and the toxicity of each surfactant should be considered for addressing the consequences on the overall risk. No substantial modifications in the risk for freshwater ecosystems are expected as the surfactant removal in the WWTP seems to be regulated by its aerobic biodegradability. Regarding the magnitude of the environmental risk of surfactants other than LAS, the Fraunhofer´s report does not include enough information for allowing the Committee to evaluate the selected effect assessment values, therefore, the SCHER cannot produce an opinion on their actual risk.

- The risk assessments conducted in the documents submitted to the SCHER are based on the assumption that effluents are treated through a "generic" WWTP facility before reaching water bodies. Therefore, the SCHER does not have information for commenting on the impact of the implementation of this Directive.

- The requirement for ready an ultimate biodegradability under anaerobic conditions is not by itself regarded as an effective measure for environmental protection.

- No evidence is given that ISO 14853 was a more predictive method than other standardised test methods for evaluating anaerobic biodegradation of detergent surfactants. Actually, testing conditions of ISO 14853 (1999) are very similar to those of other methods such as ISO 11734 (1995) and the ECETOC (1998) tests. Data on anaerobic biodegradability of 9 different surfactants discussed in the Fraunhofer report were obtained by applying the ISO 14853 test method. Biodegradation tests were performed at 100 mg C/L and 50 mg C/L surfactant concentrations. However, these initial surfactant concentrations in the standard test should be lowered to avoid potential inhibitory effects of the surfactant on the anaerobic microbial consortia. Recent studies have indicated that single tests for evaluating anaerobic biodegradation are not sufficient, and that a combination of different testing conditions would be more appropriate.

- Considering the overall values a generic estimation of low risk for most applications of aerobic sludge and anaerobic sludge submitted to aerobic processes and a potential risk for some applications of anaerobic sludge can be expected. The real risk would also depend on the amounts of applied sludge, and therefore on its nitrogen and phosphorous content. No such information is available in the reports submitted to the SCHER. The evaluation of potential relationship between LAS, nitrogen and phosphorous concentration in anaerobically produced sludge would provide information relevant for this risk assessment.

- Concerning the risk assessment of LAS presented in the HERA report, the Committee accepts the risk characterisations and the conclusions. The Committee also notices that the conclusions for soil organisms are based on monitoring data while a potential risk is suggested by model estimations.

- The risk assessment of LAS included in this opinion suggests that most sludge applications have low risk for soil organisms. There is a potential concern however, for some combination of worst case environmental conditions (PEC/PNEC values slightly above 1) but the SCHER cannot evaluate the realism of these combinations, i.e. do these occur under standard sludge application practices. It is suggested that the effects, if any, will be local and rapidly reversible (as suggested by field studies).

- The SCHER is also concerned by the high measured levels of other surfactants in sewage sludge, including some groups of surfactants which are anaerobically biodegraded. The limited amount of information presented for APE and AE indicates measured concentrations in the range of 500-1000 mg/kg. However, as there is a lack of information on the toxicity of these chemicals to soil organisms, a risk assessment cannot be performed. The risk of NPE and NP has been discussed in previous opinions of the CSTEE and therefore these substances were not assessed in the present opinion.

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6. LIST OF ABBREVIATIONS

AE	Alcohol ethoxylates
APE	Alkylphenol ethoxylates
CSTEE	Scientific Committee on Toxicology, Ecotoxicology and the Environment
DSDMAC	Distearyldimethylammoniumchlorid
DTDMAC	Ditallowdimethyl ammonium chloride
DT50	Degradation (dissipation) half-life
ECETOC	European Chemical Industry Ecology and Toxicology Centre
HERA	Human & Environmental Risk Assessment on ingredients of European Household Cleaning Products
ISO	International Organization of Standardization
LAS	Linear alkyl benzene sulphonates
NOEC	No Observed Effect Concentration
NP	Nonylphenol
NPE,	Nonylphenol ethoxylate
PAH	Poly Aromatic Hydrocarbons
PEC	Predicted Environmental Concentration
PNEC	Predicted No Effect Concentration
TGD	Technical Guidance Document
UASB	Up flow Anaerobic Sludge Bioreactor
WWTP	Wastewater Treatment Plant

7. ACKNOWLEDGEMENTS

Members of the working group are acknowledged for their valuable contribution to this opinion. The members of the working group are: Prof P. Calow, Dr MT Garcia Ramon (external expert), Prof M Nuti (rapporteur), Prof JV Tarazona, and Prof G Vallini (external expert).