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HA oils in automotive tyres

– prospects of a national ban

Report on a government commission

THE SWEDISH NATIONAL CHEMICALS INSPECTORATE

HA oils in automotive tyres

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Foreword

The Swedish Government has commissioned the National Chemicals Inspectorate to investigate the prospects of a Swedish ban on the use of highly aromatic oils (HA oils) in automotive tyres. A report was to be submitted by 31 March 2003.

The commission has been carried out as a project within the National Chemicals Inspectorate's Strategies and Incentives Unit, in which the following have taken part: Inger Cederberg (project leader), Christina Törnstrand (legal analysis), Göran Gabrielsson (impact analysis), Anna Nylander (hazards to health and the environment) and Johanna Lissinger.

A broad base has been aimed for, both nationally and at the EU level. A national reference group consisting of affected authorities and industry organisations was linked to the work. This reference group has contributed specialist knowledge during the course of the investigation. At the European level, contacts have been made and discussions held with the European Association of the Rubber Industry (BLIC), and with the German Federal Environmental Protection Agency (Umweltbundesamt).

Solna, 28 March 2003

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Summary

On 27 June 2002, the Swedish Government decided to commission the National Chemicals Inspectorate to investigate the prospects of a Swedish ban on the use of highly aromatic oils (HA oils) in automotive tyres.

An HA oil is a residual product formed in the manufacturing of lubricant oils. HA oils contain high concentrations of polycyclic aromatic hydrocarbons (PAH), several of which are classified as carcinogenic. PAHs are generally also fat-soluble, often not readily degradable in the environment (persistent) and capable of accumulating in living organisms.

HA oils are added in the manufacturing of automotive tyres to make the rubber polymer easier to work and to make the tyre tread soft. Every year, large quantities of the treads of tyres in the form of small rubber particles containing HA oils are dispersed along roads as a result of wear.

Considerable progress has been made since the publication of the National Chemicals Inspectorate report “Nya hjulspår/New Wheel Tracks” (KemI report 6/94) in 1994. The report describes the problems with HA oil in automotive tyres and has contributed to activities in Sweden as well as in Europe as a whole.

In 1997, Continental Gislaved Däck AB presented the first newly manufactured winter tyre free of HA oil in the tread. Today, around 75% of newly manufactured winter tyres are free of HA oil in the tread. Retreaders, as well as manufacturers of truck tyres, were also quick to replace HA oil in the tread. The first retread tyres free of HA oils in the tread came in 1995. On the other hand, the situation is largely unchanged with regard to newly manufactured summer tyres for light vehicles. These still contain HA oils in the tread because of problems with wet grip, which is of decisive importance to braking distance and therefore road safety. Tests show that braking distance is 2-4% longer on a wet road surface for summer tyres which are made with low-aromatic oils in the tread compared with tyres which are made with HA oils in the tread. Calculating on the basis that summer tyres account for around 60% of the aftermarket and that just over 1 million originally fitted tyres are put on the road through sales of new cars, almost 4 million tyres containing HA oil in both the tread and tyre carcass are supplied to the Swedish market annually.

Since Continental Däck AB closed down its manufacturing facility in Gislaved in July 2002, Sweden has no domestic manufacturing of new automotive tyres. The Swedish automotive industry is therefore entirely dependent on tyres from manufacturers outside Sweden, particularly from other European countries. In view of the small market which Sweden represents, less than one per cent of the world market for the sale of new passenger cars and tyres and less than two per cent of the EU market, Swedish players have little opportunity to specify requirements for the HA oil content of tyres. In addition, the individual companies in the Swedish tyre industry are small, with one to twelve employees.

Passenger cars registered after 1 January 1998 must have type approval before they are released onto the market. The car is type-approved together with its tyres. A type approval granted in one Member State is valid throughout the EU. No Member State can therefore prohibit type-approved vehicles or type-approved tyres with added HA oil being placed on the market. The fact that the requirement of type approval today only covers passenger cars registered after 1 January 1998 provides some scope for introducing a national ban on HA oil in tyres of heavy goods vehicles and light trucks, heavy and light buses, retreaded tyres and tyres of passenger cars registered before 1 January 1998. According to information from the Swedish tyre industry, however, both car tyres and truck tyres made by the major tyre manufacturers are type-approved, partly because several Member States require them to be so. The same applies to retreaded tyres. On the other hand, the industry believes that there are a small number of low-price tyres imported from third countries which are not type-approved, as well as a few small retreaders who are not yet certified to label their tyres as type-approved. It should be added, however, that retreaded tyres manufactured in Sweden are already free of HA oil in the tread. Altogether, a few hundred thousand such tyres are supplied to the Swedish market annually. A unilateral national ban would only affect a few per cent of the total annual supply of tyres. A further decrease in this proportion is to be expected in 2005. Requirements for type approval will then also apply to tyres for trucks and buses and to retreaded tyres.

A unilateral national ban is therefore not effective in itself, apart from being a way of putting the issue on the European Community agenda. Sweden should therefore also consider other avenues, so that an equivalent ban can be introduced through a change in Community legislation.

The European Association of the Rubber Industry (BLIC), which brings together the major international tyre manufacturers who have production

in Europe, estimates that the use of HA oils in all new types of tyres may have ceased by 2008. BLIC considers Community-wide rules to be necessary if it is to be possible to ensure that this substitution takes place.

The German environmental protection agency, the Umweltbundesamt (UBA), is working intensively on strategies for a phase-out of HA oils in automotive tyres and has drawn up a basis for an EU-wide regulation and presented it to the Commission. The UBA's view is that a ban on HA oils in automotive tyres could come into effect earlier than the BLIC estimates.

Both the UBA and the BLIC prefer a common date for entry into force for all types of tyre, with the exception of retreaded tyres, where it is proposed that the entry into force should only cover requirements for the tread, to guard against the elimination of retreaders as an industry.

The prospects for gaining acceptance for Community-wide regulation of HA oils in car tyres should therefore be good, as two important European players are working towards this. The EU market, accounting for around 36% of the world tyre market, also represents a large customer base and therefore also provides an incentive for non-European tyre manufactures to follow developments in Europe.

A suitable strategy may therefore be to call on the Commission for an EU-wide ban on HA oils. The necessary basis for the amendment of Community legislation to be endorsed and have an effect can be strengthened through co-operation with Germany.

If the Swedish Government opts to notify a proposal for a national ban on HA oils in automotive tyres, this proposal too should be harmonised with the proposal, which Germany is preparing. The submission of a proposal for a national ban on HA oils in automotive tyres entails a requirement to follow the procedure laid down in Directive 98/43/EC (on an information procedure regarding technical standards and specifications). A submission of this kind must include a risk analysis and an assessment of proportionality in relation to Articles 28 and 30 of the Treaty establishing the European Community.

The German proposal in its present version is not complete. Sweden should be clear on the point that a ban should be aimed both at the use of HA oils in the manufacturing of tyres and at tyres containing HA oils.

The oil must not be used in the manufacture of tyres if it fulfils the criteria of carcinogenicity, and contains more than 10 ppm in total of the twelve designated PAHs or more than 1 ppm of benzo(a)pyrene.

In order to be able to supervise compliance with the ban, reference should be made to the modified IP 391 method, pending the development of a more sensitive method. There should be a requirement for the concentration of PCAs in the oil contained in the tyre not to exceed 10 % according to this method to ensure that the oil does not fulfil the classification criteria of carcinogenicity.

Considering the time required to carry out the practical work to implement complete replacement of HA oils in both treads and carcasses, the National Chemicals Inspectorate estimates a feasible point of time for entry into force of a ban to be 1 January 2006, which is in line with the standpoint of Germany

The National Chemicals Inspectorate proposes as follows:

- **Sweden should actively urge an EU-wide ban on HA oils in automotive tyres by presenting a notification to the Commission in accordance with Article 95.8 of the Treaty establishing the European Community. Sweden should co-operate in this work with Germany for a ban to include both the use of HA oils when tyres are manufactured and tyres containing HA oils.**

- **A national ban on HA oils in automotive tyres can only include tyres that are not type-approved, which corresponds to a few per cent of the tyres placed on the market each year. If the Swedish government chooses to formulate and notify a national ban, it should have the wording below.**

Ordinance on the Prohibition of Highly aromatic Oils in Certain Tyres

Issued on xx

The Government prescribes as follows.

Section 1: For the purpose of this Ordinance, the following definitions shall apply:

1. *tyre,* pneumatic tyre, as original or spare tyre, which is intended for fitting to vehicles which are covered by Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers,
2. *PAHs,* polycyclic aromatic hydrocarbons,
3. *PCAs,* PAHs and polyaromatics substituted with sulphur, nitrogen or oxygen compounds.

Section 2: In the manufacturing of tyres or treads for retreaded tyres, oils shall not be used which
- contain PAHs which are to be classified as carcinogenic in categories 1 or 2 under applicable regulations on the classification and labelling of chemical products;
- contain one or more of the PAHs stated in the annex in a total concentration amounting to 10 ppm or more, or,
- contain benzo(a)pyrene in a concentration amounting to 1 ppm or more.

Section 3: Tyres and treads for tyres intended for retreading shall not be released onto the market if they contain oils as referred to in Section 2. The tyre or tread shall not be regarded as containing such oils if the concentration of PCAs is less than 10% in measurement according to the method indicated by the annex.

Section 4: The provisions of Sections 2 and 3 shall not apply to tyres which have been type-approved in accordance with Council Directive 92/23/EEC of 31 March 1992 relating to tyres for motor vehicles and their trailers and to their fitting or are type-approved in accordance with ECE Regulations 30, 54, 64, 108 and 109.

Section 5: Further regulations relating to implementation of this Ordinance, will be notified by the National Chemicals Inspectorate

Section 6: Chapter 29 of the Environmental Code contains provisions on penalties and forfeiture.

This Ordinance comes into force on 1 January 2006.

On behalf of the Government

Annex

PAHs referred to in Section 2

PAH	*CAS number*
Fluoranthene	206-44-0
Pyrene	129-00-0
Benzo(a)anthracene	56-55-3
Chrysene/Triphenylene	218-01-9
Benzo(b)fluoranthene	205-99-2
Benzo(j)fluoranthene	205-82-3
Benzo(k)fluoranthene	207-08-9
Benzo(e)pyrene	192-97-2
Benzo(a)pyrene	50-32-8
Dibenzo(a,h)anthracene	53-70-3
Indenol(1,2,3-c,d)pyrene	193-39-5
Benzo(g,h,i)perylene	191-24-2

Method for measurement of PCAs according to Section 3

The following standards shall be applied in the measurement of PCA in the oil:

SS 155116 Petroleumprodukter - Bestämning av aromater i dieselbrännolja - Mono- och dicykliska aromatiska föreningar samt PAH, vilken motsvarar IP 391/90 Aromatic hydrocarbon types in diesel fuels petroleum distillates by high performance liquid chromatography with refractive detection, equivalent to IP 391/90.

SS-ISO 1407 Edition 1. Gummi - Bestämning av halten extraherbara ämnen, vilken motsvarar ISO 1407:1992 Rubber – Determination of solvent extract, equivalent to ISO 1407:1992.

SS-ISO 4645 Edition 1. Gummi och gummiprodukter - Vägledning för identifiering av skyddsmedel - Tunnskiktskromatografiska metoder, vilken motsvarar ISO 4645:1984 Rubber and rubber products - Guide to the identification of antidegradants - Thin layer chromatographic methods, equivalent to ISO 4645:1984.

1. Introduction

1.1 The commission

The Swedish Government decided on 27 June 2002 to commission the National Chemicals Inspectorate to investigate the prospects of a Swedish ban on the use of highly aromatic oils (HA oils) in automotive tyres.

The commission includes:

- assessing the need for changes to relevant legislation
- if changes are needed, making proposals for such changes
- preparing data for notification under Directive 98/34/EEC (laying down a procedure for the provision of information in the field of technical standards and regulations)
- calculating the costs of proposed measures
- analysing the socio-economic effects of the proposals and their effects on public finances
- analysing the consequences for other goals which have been set by the Swedish Parliament
- paying special attention to the effects on small and medium-sized enterprises

The report on the commission is due to be delivered by 31 March 2003, and the work is to be carried out in collaboration with affected authorities, organisations and other stakeholders.

1.2 Reasons for the commission

In 1999, the Swedish Parliament (Riksdag) adopted the environmental quality objective of a Non-Toxic Environment (1998/99:MJU6). Two years later, six interim targets towards achieving a Non-Toxic Environment were adopted. One of the interim targets is that newly manufactured products, used in such a way that they enter the eco-cycle, should be free of substances that have particularly hazardous properties not later than 2007. The phrase substances that have particularly hazardous properties is understood to mean those that can cause cancer, damage genetic material, are harmful to reproduction and substances that are persistent in the environment and are capable of accumulating in living organisms. HA oils contain several polycyclic aromatic hydrocarbons (PAHs), which have the properties concerned.

The Government considers that as the use of HA oils has not ceased voluntarily and as there are alternative oils, there are strong grounds for an early ban on the use of HA oils in automotive tyres.

1.3 Previous report

In National Chemicals Inspectorate report 6/94, it was judged that the highly aromatic oils pose by far the greatest risk from the point of view of health and the environment during the time tyres are being used. The reason for this judgement was:

- the hazard posed by HA oils to health and the environment
- large quantities of HA oils are used in automotive tyres
- the oil is not changed during the vulcanisation process and is still present in the finished tyre
- the oil is present in the wear particles dispersed along roads

The report was commissioned by the National Chemicals Inspectorate and Västra Götaland County Administration. The authors of the report are Jan Ahlbom and Ulf Duus.

1.4 The work of the National Chemicals Inspectorate on this report

1.4.1 Delimitation

The term 'automotive tyres' in this report means tyres for passenger cars, trucks and buses, which account for about 90% of the rubber-tyre market. This interpretation was jointly adopted at the first meeting of the reference group.

1.4.2 Methodology and structure of the report

The investigation began with a survey of how the phasing-out of HA oils in automotive tyres has progressed since the previous report in 1994. Alongside this survey, an in-depth legal analysis was made of whether it is possible to introduce a Swedish ban on HA oils in automotive tyres under Community law, and if it is not possible what other options there are to persuade the European Commission to examine the question of introducing an equivalent ban at EU level in some other way. The legal analysis has been undertaken in close cooperation with the Swedish Environmental Protection Agency (Naturvårdsverket) and the National Road Administration (Vägverket), as they are responsible for some of the European Community directives relating to vehicles and tyres.

It emerged at an early stage of the legal analysis that if a ban on HA oils in automotive tyres is to be effective, it must be implemented through Community legislation. The perspective therefore needed to be broadened, and two important players in the European market were

identified: BLIC[1], the European Association of the Rubber Industry, and Germany, which has a large automotive industry. A meeting was held with BLIC, and several contacts were established with the German Federal Environmental Protection Agency (Umweltbundesamt - UBA) to coordinate with their work aimed at bringing about EU-wide regulation of HA oils. In addition, contact was established with the Dutch environmental agency and the Nordic environmental agencies. None of them have HA oils in automotive tyres on their agendas, but they are interested in learning about the work being done by the National Chemicals Inspectorate.

The commission also includes preparing data for notification of a national ban under Directive 98/34/EEC to the Commission. The Directive states that such a notification is to contain a risk analysis. The brief period of investigation did not, however, allow for an in-depth risk analysis.

The chapter on hazards to health and the environment is therefore based on existing data. A brief account is given in this chapter of what inherent properties some of the PAHs contained in HA oils have. An account is also given of some calculations, which have been made in order to quantify the proportion of PAHs in the environment originating from automotive tyres.

An impact analysis has been made of two alternative actions – a national ban and a ban at EU level. The assessments are compared with a "zero scenario", i.e. a scenario where no further action is implemented over and beyond that which is under way or has been decided upon by the authorities.

The chapter on "Considerations and proposals" discusses the conclusions drawn from the legal analysis and the impact analysis. Together with the picture of how the phasing-out of HA oils is progressing in Europe, a summing-up is made, leading to the proposals presented at the end of the report.

1.5 Reference group

Broader external consultation has taken place through a reference group consisting of representatives of authorities affected, the tyre sector and the rubber industry. After the first meeting of the reference group, several contacts were made with the participants in the reference group to obtain up-to-date information and discuss opportunities for and obstacles to a

[1] Bureau de Liaison des Industries du Caoutchouc de l'U.E.

phase-out of HA oils. A study visit to learn about the techniques used in retreading tyres also took place. A separate meeting was also held with Nynäs Naphtenic AB to find out more about alternative low-aromatic oils.

The participants in the external reference group are listed in Annex 1.

2. Health and environmental risks of HA oils

2.1 What is an HA oil?

A highly aromatic oil (HA oil) is an oil extract obtained at refineries when the base oil is purified for further production, for example of lubricant oils. In this process, aromatics are washed out using solvents. The solvent is then driven off and a highly aromatic residue is left, known as the HA oil extract. Highly aromatic oil also goes under the name of DAE[2].

The HA oil contains large amounts of aromatic and polycyclic aromatic hydrocarbons (PAHs). Substances with two or more condensed aromatic rings are generally counted as PAHs. According to method of measurement IP 346, which is described in Chapter 4, the concentration of PAHs can amount to 10-30%. Other constituents of the oil are naphthenic and paraffinic hydrocarbons, as well as mono- and diaromatic hydrocarbons.

Table 2.1 lists examples of some individual PAHs which may be contained in an HA oil measured by GC-MS analysis.

[2] Distillate aromatic extract (DAE), usually identified by CAS number 64742-04-07.

Table 2.1 *Examples of individual PAHs which may be contained in an HA oil. Method of measurement: GC-MS analysis. Source: National Chemicals Inspectorate report 6/94.*

Individual PAHs	*CAS no.*	*Concentration (ppm)*[3]
Fluoranthene	206-44-0	11.0
Pyrene	129-00-0	25.6
Benzo(a)fluorene	238-84-6	0.9
Benzo(a)anthracene	56-55-3	34.2
Chrysene	218-01-9	395.3
Benzo(b)fluoranthene	205-99-2	72.9
Benzo(e)pyrene	192-97-2	113.2
Benzo(a)pyrene	50-32-8	13.4
Dibenzo(a,j)anthracene	224-41-9	4.6
Dibenzo(a,h)anthracene	53-70-3	5.7
Indenol(1,2,3-c,d)pyrene	193-39-5	6.2
Benzo(g,h,i)perylene	191-24-2	17.9
Antanthrene	191-26-4	6.6
Total		707.5 (0.07 %)

2.2 Use of HA oils

HA oils today are used among other things in the manufacturing of tyres. Examples of other areas of use are the manufacturing of rubber sheets, which are used for noise reduction alongside roads. If the need for HA oil were to be met by another oil instead, the HA oil could undergo further processing into petrol or naphthas. This means that there is no risk of the oil companies ending up with a residual product for which there is no market. The manufacturer of the rubber polymer adds the HA oil to reduce viscosity and improve the "stickiness" of the uncured rubber blend, but also to make the polymer go further and consequently keep manufacturing costs down. The oil is dissolved in the rubber blend but does not react with it. The tyre manufacturer adds further HA oil to make the tyres soft.

The annual requirement for HA oil for the European tyre market is 250,000 tonnes, which is used in the manufacturing of 2.1 million tonnes of car tyres, of which 60,000 tonnes of tyres are consumed in Sweden. A very large proportion of the treads of tyres, around 10,000 tonnes, is

[3] According to GC-MS analysis, i.e. measurement using gas chromatography and mass spectrometry.

dispersed annually along Swedish roads by tyre wear in the form of small rubber particles.

2.3 General information on hazards to health and the environment

The polycyclic aromatic hydrocarbons contained in the HA oil are a complex group of substances, many of which are harmful to health and the environment. Several of the PAHs contained in HA oils are classified as category 2 carcinogens in the Community-wide classification list (KIFS 2001:3)[4]. The compounds classified according to this system are listed in Table 2.2. Several of them are also included in the framework directive on water policy and in several international conventions on the basis of their inherent hazardous properties (see also Chapter 5).

PAHs are the largest group of carcinogenic substances known today. Much of their effect is linked to the flat structure of the molecule and their ability to affect the DNA in the cell nucleus. Most living organisms can convert PAHs, but the breakdown products which are then formed can very often prove to be more harmful than the original substance.

The group of PAHs is made up of several hundred individual chemicals, and more than 500 different PAHs have, for example, been detected in air. PAHs occur in the air in gaseous form, bound to particles or dissolved in water droplets. Measurements show that low-molecular PAHs occur mostly in gaseous form, while the high-molecular compounds mostly occur bound to particles in the air (Johansson et al., 2001).

PAHs are in general fat-soluble, mostly stable and in some cases bioaccumulative. The fact that the compounds are stable means not just that they are difficult to break down but that they can be dispersed a long way before breakdown takes place.

In aquatic environments, PAHs are principally bound to particles, which are then transported to the sediments, where they become very long-lived. Aquatic ecosystems close to discharge sources are most exposed to PAH emissions. Many PAH compounds are bioconcentrated in invertebrates in the aquatic environment and are enriched in the food chain. Mussels, for example, have a poor ability to break down PAHs, leading to the compounds accumulating in the mussels.

[4] Regulations amending the National Chemicals Inspectorate regulations (KIFS 1994:12) on classification and labelling of chemical products.

2.4 Individual PAHs

A brief account is given below of some properties of different PAHs. No information has been encountered for dibenzo(a,j)anthracene and benzo(a)fluorene. The most important results in this chapter are summarised in Table 2.2 below.

Antanthrene

Antanthrene has been shown to be carcinogenic. There is insufficient evidence today to say with certainty that the compound is genotoxic[5] (IPCS, 1998).

Benzo(a)anthracene

Benzo(a)antracene is a persistent[6] and bioaccumulative[7] compound. The compound has been shown to be genotoxic. Effects on the stomach, liver and kidneys have been observed following exposure of experimental animals (IPCS, 1998). The compound is classified in the (KIFS 2001:3) as a category 2 carcinogen, which is harmonised in the classification list agreed at Community level.

Benzo(a)pyrene

Benzo(a)pyrene is the compound best known and studied of all the PAHs. Benzo(a)pyrene is persistent and has the ability to bioaccumulate (IPCS, 1998). The compound has relatively low volatility, which means that it does not remain airborne for a particularly long time. Benzo(a)pyrene has been proven to cause cancer, be genotoxic and be harmful to the embryo. The compound is classified as carcinogenic, mutagenic and toxic to reproduction in category 2 (KIFS 2001:3).

Benzo(b)fluoranthene

Benzo(b)fluoranthene is a persistent and bioaccumulative substance (IPCS, 1998). The compound is classified as a category 2 carcinogen (KIFS 2001:3) and has been shown to be genotoxic in studies.

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[5] I.e. harmful to the genetic material, DNA and chromosomes.

[6] For a compound to be regarded as persistent according to the EU's Technical Guidance Document (TGD), the half-life in seawater has to be longer than 60 days, the half-life in freshwater longer than 40 days or the half-life in marine sediments longer than 120 days.

[7] For the criterion of bioaccumulation to be fulfilled (according to the TGD criteria) a bioconcentration factor (BCF) > 2 000 is required or, if BCF data are lacking, log Kow must be > 4.5.

Benzo(e)pyrene

Benzo(e)pyrene is a bioaccumulative substance. It has been shown that the substance leads to cancer in the event of skin exposure. However, there is doubt over the results, and further studies are required. The compound is also genotoxic (IPCS, 1998).

Benzo(g,h,i)perylene

Benzo(g,h,i)perylene is a persistent and bioaccumulative substance. The compound is not carcinogenic but has been shown to be genotoxic in animal studies (IPCS, 1998).

Chrysene

Chrysene is a persistent and bioaccumulative compound. The substance has been shown to be carcinogenic and genotoxic (IPCS, 1998).

Dibenzo(a,h)anthracene

Dibenzo(a,h)anthracene is a persistent and bioaccumulative compound. Animal experiments show the compound to be carcinogenic and genotoxic. Liver changes have also been observed due to exposure (IPCS, 1998).

Fluoranthene

Fluoranthene is a persistent and bioaccumulative substance. The compound has been shown to be genotoxic and carcinogenic in experimental animals. The cancer results are, however, based on few studies. Animal studies have also pointed to increased liver enzyme activity and kidney problems, which have increased with rising dose (IPCS, 1998). Phototoxic reactions[8] have also been observed following administration of the compound to experimental animals.

Indeno(1,2,3-c,d)pyrene

The compound is persistent and bioaccumulative. Studies have also shown that this compound is carcinogenic and genotoxic (IPCS, 1998).

Pyrene

Pyrene is a persistent and bioaccumulative compound. Laboratory experiments on rats have pointed to liver damage after exposure. Mice have exhibited damage to kidneys following exposure to the substance. Phototoxic reactions have also been observed following administration of the compound to experimental animals. Too few studies are available to

[8] Toxicity of a substance when the skin is exposed to a compound together with light.

assess whether this compound is genotoxic and carcinogenic (IPCS, 1998).

Table 2.2 *Some important properties of PAHs contained in HA oil.*

Substance	*Persistent*	*Bioaccumulative*	*Carcinogenic*[9] *(category 2)*
Antanthrene			(+)
Benzo(a)anthracene	+	+	+
Benzo(a)pyrene	+	+	+
Benzo(b)fluoranthene	+	+	+
Benzo(e)pyrene		+	?
Benzo(g,h,i)perylene	+	+	-
Chrysene	+	+	(+)
Dibenzo(a,h)antracene	+	+	(+)
Fluoranthene	+	+	?
Indeno (1,2,3-c,d)pyrene	+	+	(+)
Pyrene	+	+	?

The criteria for persistence and bioaccumulability originate from the TGD[10].
+ = persistent, bioaccumulative or classified as category 2 carcinogenic in the Community-wide classification list (KIFS 2001:3).
(+)= has caused cancer in experimental animals but is not classified as carcinogenic.
? = too few studies are available to assess whether the substance is carcinogenic.
- = negative result. Blank box = studies lacking.

2.5 Sources for the occurrence of PAHs in the environment

Traffic is a significant source for emissions of PAHs to the air environment in large cities. The traffic-related sources are vehicle exhausts, wear of automotive tyres and wear of road material. Small-scale wood-burning also contributes to PAHs in our surroundings. A large proportion of the pollutants dispersed into the air finally end up in the aquatic environment, where they can accumulate in sediments. Examples of other sources for the dispersal of PAHs to sediments are wastewater, industrial facilities, factories which manufacture rubber and petrol filling stations.

[9] Source IPCS, 1998.
[10] Technical Guidance Document/*Technical guidance document in the programme for existing substances in the EU.*

Emissions from vehicles occur in various forms. Vehicle exhausts contain PAHs bound to particles but also in gaseous form. When tyres become worn, articles containing a large quantity of polycyclic aromatic hydrocarbons are released. Particles from road wear mainly consist of minerals from the stone material in the road covering and a smaller amount of bitumen[11].

PAHs which are released via tyre wear and which are bound to larger particles, larger than a few µm, are not dispersed particularly far from the road surface before they fall to the ground. These particles have a high rate of fall and therefore spend a relatively short time in the air (Johansson et al., 1998). The small particles are moved with the aid of the wind or as a result of traffic turbulence to the area near the road. The larger particles are flushed away with the surface runoff and end up in the sludge of sewage treatment works or are conveyed to a receiving body of water where the particles sediment. Some direct dissolving and release of PAHs takes place when sediments are churned up by dredging or similar operations.

It has not been possible to make a reliable and uniform quantification of the PAH contribution from tyre wear out in the environment in relation to other PAH sources, such as road coverings, vehicle exhausts, wood-burning, industrial incineration processes and fallout via precipitation. Instead, an account is given of some calculations made for the Stockholm area and the estimates presented in KemI report 6/94. The National Chemicals Inspectorate is aware that the estimated contribution differs in magnitude between the different calculations. One explanation may be that the calculations are based on different analytical methodology and sensitivity of analytical instruments. Another explanation may be that different PAHs have been measured. No further analysis has been made of the differences, and the figures are only presented with reference to the literature.

The sediments in the aquatic areas of Stockholm provide important information on how activities in society affect the environment. The result from emissions in recent years can be measured in the surface sediments, while the deeper sediments can be used to detect previous historical emissions.

[11] Bitumen is an oil product used to bind the stone material together in the asphalt.

Measurements which have been made in the Stockholm area suggest that the annual contribution of PAHs from tyre wear is of the order of 120 kg, which is 4% of the emission via exhaust gases from petrol- and diesel-powered vehicles. Other measurements in the Stockholm area estimate that vehicle exhausts together with tyre wear account for 30% of the PAH level in sediments. It must be added, however, that some of this quantity may also be due to atmospheric fallout. The samples were taken at four different depths of the sediment, 2-4 cm, 18-26 cm, 34-44 cm and 50-62 cm. Vehicle exhausts and tyre were assessed as being the largest identified sources of the occurrence of PAHs in sediments (SLB analys, 2002).

In contrasts to exhausts from petrol- and diesel-powered vehicles, source and receptor calculations, based on PAH concentrations in Stockholm, show that tyre wear does not make a major contributions to PAH concentrations in the air. This may be due to the tyre particles being very large (>10 μm) and to some of them not being captured in the air sampling (Johansson et al., 2001). These particles instead are deposited within a few tens of metres from the road surface and only stay in the air for a short time. They consequently do not make a major contribution to human exposure via inhalation, but they do contribute to the PAH concentration of surface runoff.

The particles formed in the wear of studded tyres, like the asphalt, consist to around 95% of mineral from the stone material in the road covering. The other 5% consists of bitumen. Bitumen also contains PAHs, but only a few ppm, and asphalt is therefore not assumed to be a principal source of PAHs in the road environment (Gustafsson, 2001). According to another calculation, the PAH concentration in bitumen amounts to 20-50 ppm in the asphalt which is used today. Older bitumen, on the other hand, may have an entirely different composition (Lindgren, 1998).

With regard to the asphalt covering on roads, there is neither a technically nor an economically feasible alternative at present according to the National Road Administration and the Swedish National Road and Transport Research Institute. Work is instead being devoted to making the asphalt more hard-wearing and the studs of winter tyres lighter in order to reduce wear.

In KemI report 6/94 the authors, Ahlbom and Duus, make a comparison between different sources of PAH emissions in Sweden. The comparison is presented in Table 2.3.

Table 2.3 *Sources and quantity of PAH emissions ('New Wheel Tracks' 6/94).*

Source	*Quantity of PAH – emissions/year*
Tyre wear	14 tonnes (corrected to 10 tonnes)[12]
Road wear (asphalt)	4.5 tonnes
Exhaust gases	38 tonnes

The trend is towards ever cleaner exhaust gases thanks to catalytic converters in petrol-powered vehicles and a change-over to cleaner diesel (environmental class I). In Sweden, requirements were introduced for exhaust cleaning from vehicles put on the market after 1989[13]. Equivalent requirements at EU level were introduced in 1992[14]. The authors of KemI report 6/94 judge that a passenger car fitted with a catalytic converter per kilometre causes a greater quantity of PAH emissions from tyres than from the exhaust gases: 28 µg compared with 5 µg per kilometre. According to figures supplied by the automotive industry, 80% of passenger cars on the road at present are fitted with catalytic converters to clean their exhaust gases. In terms of the total number of kilometres driven, the proportion of kilometres driven by cars fitted with catalytic converters is 90% (personal communication, Karin Kvist, January 2003).

Following publication of the KemI report, BLIC presented its own calculation of the contribution of PAH emissions from automotive tyres[15]. According to their calculation, the contribution of PAHs from automotive tyres is of the order of 0.3 – 0.5 tonnes per year in Sweden. A passenger car fitted with a catalytic converter, according to the BLIC estimate, gives rise to 4.5 µg PAH emissions per kilometre.

On behalf of the German environmental protection agency, the Umweltbundesamt (UBA), the University of Dortmund has carried out studies on chemical substances in automotive tyres. In the report[16] based

[12] The correction was made approximately six months after publication of the report New Wheel Tracks 6/94.
[13] The statutory rules were contained in the Vehicle Exhausts Act 1986:1386, which was complemented by the Vehicle Exhausts Ordinance 1987:586
[14] Directive 70/220/EEC, as amended by 91/441/EEC.
[15] BLIC response to KEMI report concerning the possible environmental effect of aromatic oils in tyre tread compounds, February 1995.
[16] Exemplarische Erfassung der Umweltexposition ausgewählter Kautschukderivate bei bestimmungsgemässer Verwendung in Reifen und deren Entsorgung (Example recording of enviornmental exposure of selected rubber derivatives used according to directions in tyres and their disposal), 1997.

on the studies, the quantity of particles from tyre wear is calculated as 65,000 tonnes per year in Germany. Depending on the method of measurement, the quantity of PAH emissions from tyre wear is estimated to be of the order of 6-18 tonnes per year.

2.6 PAH in sediments in the Stockholm archipelago

The Institute for Applied Environmental Research at the University of Stockholm has presented a study carried out on behalf of the City of Stockholm Environment and Health Administration together with Stockholm Vatten AB[17].

The occurrence of a number of organic substances and metals in sediment particles was analysed from samples collected from three different locations in the central waterways of Stockholm: Klubben, Riddarfjärden and Kastellholmen. The samples were collected during the years 96/97, 97/98 and 98/99 using sediment traps positioned 15-20 metres beneath the water surface (Broman et al., 2002).

2.6.1 Biological effects

The biological part of the study, mentioned above, was carried out by exposing embryos of rainbow trout to the substances found in the sedimented particles and then examining the biological effects of these.

Elevated EROD activity[18] in the liver, deformations and mortality were observed in both fish embryos and fish larvae. The result pointed to a strong effect on the detoxification system in the testing of sediment samples from all stations.

Heart and yolk sac oedema (abnormal accumulation of fluid) and damaged mouth parts were other toxicological effects observed in alevins. The alevins were exposed by injection at the roe stage (Åkerman et al., 2002).

The effects observed in the laboratory experiments are being examined in the field under a three-year EU project, BEEP[19]. The studies extend along a gradient from the inner city of Stockholm out to the Björkskär archipelago, in the Baltic Sea proper. The preliminary results from the

[17] Stockholm Vatten AB produces and deliver drinking water to people in Stockholm and neighbouring municipalities and treat wastewater from Stockholm and neighbouring municipalities.
[18] Activation of the detoxification system, the activity reveals dioxin-like substances.
[19] Biological Effects of Environment Pollution in Marine Coastal Ecosystems.

field studies confirm that the effects observed in the laboratory can also be detected in stationary fish.

The Department of Zoology, Zoophysiology at the University of Göteborg has carried out a study on fish exposed to automotive tyres. This study showed that PAHs leached from rubber tyres, were absorbed by the fish and caused very substantial induction of EROD activity (personal communication, Lars Förlin, 2002).

2.7 Summary and conclusions

HA oils, as the name suggests, contain large amounts of aromatic and polycyclic aromatic hydrocarbons. This is a large group of compounds, many of which have harmful effects on health and the environment. Most PAHs contained in HA oils have been shown to be persistent, bioaccumulative and carcinogenic. Some of them are also classified as category 2 carcinogens in the Community-wide classification list.

Traffic is a significant source for the dispersal of PAHs to the environment. The traffic-related sources are vehicle exhausts and asphalt and tyre wear. Small-scale wood-burning and industrial facilities are other large sources of PAH emissions. An estimate of approximate emissions of PAHs can be made by studying sediments in the environment. It is difficult, however, to quantity the amount of PAHs, which comes from tyre wear in relation to other sources of the dispersal of PAHs. The magnitude of the contribution varies depending on the source of information.

Calculations indicate that tyre wear does not make a major contribution to PAH concentrations in air. The tyre particles are very large and only stay in the air for a short time, and therefore do not contribute to human exposure via inhalation. On the other hand, tyre wear contributes to increased PAH concentrations in surface runoff.

Fish have been exposed to PAHs from sediment samples, and severe effects on the fish have been observed. Studies have also shown that automotive tyres leak PAHs and that fish are greatly affected by the exposure through their detoxification system being put into action.

3. Present-day use of HA oils in automotive tyres

3.1 General information on tyres

The manufacturing of automotive tyres is a complex process, which takes place in several stages. An automotive tyre consists of layers of reinforcing material of steel and textile, which is surrounded by a protective casing of rubber. The rubber is itself a mixture of synthetic rubber or natural rubber and various additives. The composition of the rubber mixture can be varied so that different properties can be emphasised or suppressed. Several different rubber blends are required as different properties are required for the different parts of the tyre.

Natural rubber is extracted from the rubber tree *Hevea Brasiliensis,* which grows in the tropical parts of South America, Africa and south-east Asia. Between 60 – 70% of the world's rubber production is used in the tyre industry. The major part of world production of synthetic rubber, around 60%, is also used for the manufacturing of tyres. The most common synthetic rubber polymer in car tyres is styrene–butadiene rubber. Synthetic rubber is manufactured in the EU, but is also imported from North and South America (PRé, 2001).

The vehicle's tyres are of great importance to road safety. Tests carried out show differences of up to 15% in braking distance with the best and worst tyres. A tyre has to have good wet grip, strength and low rolling resistance. It also has to withstand high speeds and high loads. Nor must it generate excessively high tyre noise. The tyre also affects the vehicle's fuel consumption. A vehicle manufacturer primarily makes sure that a tyre fulfils the technical requirements, which are of significance for the vehicle's performance. Technical performance and safety are not regarded as negotiable parameters.

The vital functions of the tyre such as wet grip/winter grip, rolling resistance and stability are in the tread. The requirement to be met by the tyre carcass is strength. A change in the properties of the tread may require an adjustment in the carcass to obtain the correct balance in the tyre for driving.

The depth of tread on the tyre is important for the vehicle's braking distance. Safety increases with tread depth. The depth of the tread on a new tyre is 8-10 mm. The tread for driving on wet snow-free ground must be at least 1.6 mm. For driving on a winter road surface, the tread depth must be 3 mm (The National Society for Road Safety, NTF, 2003). The life of a summer tyre depends on how quickly the tread depth

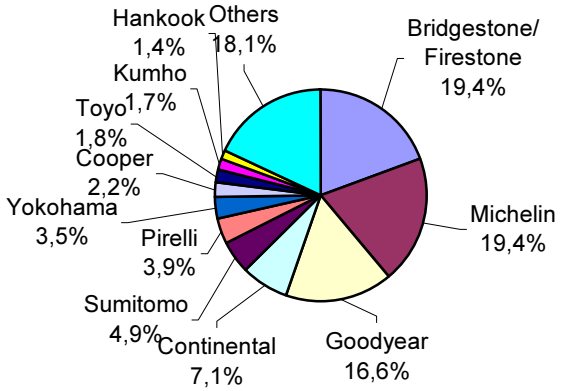
becomes worn. A summer tyre can normally be used for 4-5 years, which is equivalent to 60-70,000 km, while a winter tyre can be used for 6-7 years for the same distance driven.

The split between the number of winter and summer tyres put on the Swedish market is roughly 40/60.

3.2 The tyre sector

The global tyre market is illustrated in the diagram below. As can be seen from Diagram 3.1, the global market is dominated by three major manufacturers: Bridgestone/Firestone (Japan), Michelin (France) and Goodyear (USA).

Diagram 3.1 *The global market for tyres in 2001.*



Source: European Rubber Journal, 2001.

The Swedish market for new tyre sales is largely identical to that for Europe, except that Nokian has a larger share in Sweden and the Nordic Region. Although there are several different makes of new car tyres, there are a few companies which dominate the market through cross-ownership of different brands. The largest manufacturers in Europe are the ones which dominate in the global market: Michelin, Bridgestone and Goodyear. These account for around 70% of the European market, while Continental's share of the market as the fourth largest supplier is approximately 10%. Nokian Tyres comes 22nd in the European market (source: European Rubber Journal, October 2002). The market share for Nokian Tyres in Sweden, Norway and Finland is just over 20%.

New tyres reach the market either as originally fitted tyres on new vehicles or through the replacement market, i.e. when end-of-life tyres are replaced with new ones.

Altogether around 4.5 million car tyres a year are sold in Sweden, of which just over 1 million tyres are originally fitted on the approximately 280,000 new cars sold each year. The equivalent figure for trucks is around 0.5 million tyres a year for the aftermarket, around half of which are retreaded tyres and of the order of 200,000 – 250,000 originally fitted tyres which come onto the market on new trucks. The table below shows the number of new vehicles reaching the Swedish market in 2001.

Table 3.1 *Number of new vehicles coming onto the Swedish market in 2001.*

Tye of vehicle	*Number*
Passenger cars	
Total	246,581
Volvo and Saab	73,448
Direct imports	43,000 (new and used)
Trucks weighing < 3,550 kg	
Total	28,569 (incl. direct imports)
Trucks weighing > 3,500 kg	
Total	5,571
Volvo and Scania	4,385
Buses weighing < 3,500 kg	
Total	92
Buses weighing > 3,500 kg	
Total	1,126
Volvo and Scania	634

Source: Bilismen i Sverige 2002, (The Motoring in Sweden 2002) BIL Sweden. BIL Sweden's members account for 99 per cent of new vehicle registrations in Sweden.

There are three Swedish sector organisations, which organise companies in the Swedish tyre industry: the National Federation of Tyre Specialists, the Association of Retail Tyre Suppliers, and STRO (Scandinavian Tire and Rim Organisation). Together, they organise around 95% of all suppliers in the tyre industry, both those who sell new tyres and

retreaders. Altogether there are something of the order of 900 companies. The individual companies in the sector are small, with between one and twelve employees.

3.3 Type approval and labelling of tyres

Passenger cars registered after 1 January 1998 must be type-approved before they are allowed to come onto the market. In general, however, most cars of the 1996 model year and later are type-approved. If the code T 14 A plus an EC approval appears in the certificate of registration, this means that the car has whole-car type approval. The car's performance is approved with tyres in conjunction with the type approval. Tyres fitted to type-approved cars must therefore also be type-approved, both original tyres and replacement tyres. A type-approved tyre is marked with E or e followed by a digit surrounded by a rectangle. The E marking indicates the country in which the type approval has been issued, but not the country where the tyre has been manufactured. As the tyres are significant to the performance of the car, they must therefore not limit the car's performance. The tyres must be marked with the maximum speed they are intended for. Summer tyres have to show the speed code for which the car is type-approved. Speed class Q is sufficient for winter tyres. This information must appear in the certificate of registration for approval of the whole car. The table below lists the various marking codes for tyres.

Table 3.2 *Marking of tyres with respect to maximum speed.*

Code	*Km/hr (max.speed)*	*Type of tyre*
J	100	Trailer and caravan tyres
K	110	Truck tyres
L	120	Truck tyres
M	130	"C"[1)] and bus tyres
N	140	"C" tyres
P	150	Winter tyres RF[2)]
Q	160	Winter tyres
R	170	Summer tyres RF
S	180	Summer tyres
T	190	Summer and winter tyres
H	210	High-speed tyres
V	240	High-speed tyres
W	270	High-speed tyres
Y	300	High-speed tyres
Z	240-	High-speed tyres

[1] Tyres for smaller trucks [2] RF Strengthened tyres – cope with higher load

The procedure for having a tyre type-approved comprises both technical tests and checking of the company's quality assurance system, e.g. ISO 9002. The company's whole production process is also checked. In Sweden, the Swedish Testing and Research Institute (SP) and the National Road Administration take part in this procedure. The cost is estimated to be at least SEK 150,000 for a tyre-retreading plant. In addition, there is an annual cost of SEK 50,000 – 70,000. If the company opts to certify itself for example to ISO 9002, there is another few hundred thousand SEK and an annual cost of around SEK 50,000. This type of certification is not necessary, however, the requirement being that the company has a quality management system at least equivalent to ISO 9000 (personal communication, Christer Widholm, 2003).

Although there are no requirements for tyres for cars which were put on the market prior to 1 January 1998 to be type-approved, the view of the industry is that the majority of new tyres sold today are type-approved. There are minor direct imports of tyres which are not type-approved, chiefly from the United States and from countries in Asia. There are also a few Swedish retreaders who have not yet had their tyres type-approved but anticipate doing so during 2003. Viewed in relation to the total proportion of tyres released onto the Swedish market annually, however, the volume of tyres which are not type-approved corresponds to only a few per cent of the total number of tyres.

There are no EU-wide requirements at present for trucks to be type-approved. The industry nevertheless believes that most truck tyres, both new tyres and retreaded tyres, are type-approved and therefore marked as type-approved.

Several EU Member States have already introduced national requirements for only type-approved tyres to be allowed to be put on the market. This requirement applies to all types of tyres. Sweden will introduce the same requirements within a year on the basis of future binding rules. The EU directives on type approval are described in Chapter 6 – Legal Analysis.

3.4 Use of HA oils in different types of tyres

3.4.1 HA oils in winter tyres

In Sweden, it is a requirement to use winter tyres between 1 December and 31 March if winter road conditions are prevailing[20]. This requirement, together with the Nordic winter climate, means that Sweden is a large market for winter tyres compared with other European countries.

In 1997, Continental Gislaved Däck AB presented the first new winter tyre containing no HA oil in the tread. This tyre scored well in tests on winter tyres carried out in 1998[21], providing confirmation that it is possible to manufacture winter tyres, which perform well without any HA oils in the tread. According to representatives of the tyre industry, there are now about 70 winter tyres containing no HA oils in their treads on the Swedish market. This is equivalent to around 75% of the winter-tyre market.

In issue 22/2002 of Teknikens Värld, 12 winter tyres were tested, six with studs and six stud-free. A check was made at the same time on whether the tyres contained HA oils. Only one of the tyres was found to contain HA oil in the tread. The winter tyres formerly manufactured in Gislaved and now manufactured in Germany were also free of HA oil in the tread.

A fact which has made it easier to replace the HA oils in the tread of winter tyres is that they are not originally fitted to new tyres and that some exceptions have been made for winter tyres in the type approval. They do not need to fulfil all the requirements, but do need to meet the requirement for strength. Another explanation is that the tread on winter tyres contains a greater admixture of natural rubber than the tread on summer tyres. Natural rubber has better friction against snow and ice. Natural rubber is easier to blend with low-aromatic oil than blends of synthetic rubber. On the other hand, HA oils are still used in the other parts of the tyres. Here it is up to the manufacturers of the rubber polymers, together with the oil producers, to develop rubber blends and oils which are compatible.

Winter tyres intended for the Nordic market differ from the tyres, which have been developed for the central European market, where conditions on snow-free ground such as wet grip count most. The Nordic climate, on the other hand, calls for greater ice and snow grip.

[20] National Road Administration Regulations on Vehicles (VVFS 1994:5)
[21] In a test performed by the magazine Teknikens Värld.

The price of a new winter tyre is of the order of SEK 900 – 1,800. A retreaded winter tyre costs SEK 600 – 700.

3.4.2 HA oils in summer tyres

Virtually all newly manufactured summer tyres sold today have HA oils in both the tread and carcass. Continental Gislaved Däck AB manufactured summer tyres containing no HA oils until 1 July 2002. Since the manufacturing moved away from Sweden, it is uncertain whether the concept of HA oil-free summer tyres will remain.

The only tyre containing no HA oil available at present on the Swedish market is a tyre from Nokian Däck, where the whole tyre is free of HA oil. It is in speed class S and T, i.e. it is intended for speeds of up to 190 km/hour. However, this tyre continues to have problems with wet grip. In tests carried out in the spring of 2002, braking distance on a wet surface was 75-80% longer than on a dry surface. This is to be compared with the tyres, which performed best in the tests, where the difference in braking distance between dry and wet road conditions was of the order of 20 – 25% (personal communication, Linus Pröjtz, 2002).

Volvo Car Corporation has learnt of studies from Continental in which summer tyres containing HA oil in the tread and summer tyres with two alternative low-aromatic oils (TDAE and MES) were tested. The braking distance for a summer tyre can range from 25 to 100 metres, depending on whether the road surface is dry or wet. The braking distance for the tyres with the alternative oils was 2-4% longer on a wet road surface than for the tyres, which contained HA oil. On the other hand, the rolling distance was lower for the tyres with the alternative oils (personal communication, Sten Persson 2003). A number of process engineering problems still need to be answered before an HA oil-free summer tyre achieves the same performance as a summer tyres with HA oil in the tread. There have been problems in particular for what are known as high-speed tyres. As well as coping with the stresses at higher speeds, the requirement for wet grip and stability is higher than for other tyres.

Summer tyres are made of styrene-butadiene rubber, which is harder-wearing and has better heat resistance than natural rubber. These properties are required for high speeds. The styrene-butadiene blend which goes to the tyre industry is often stretched out with 37% highly aromatic oil. The purpose of adding oil is to increase the processibility of the polymer and keep the price down in manufacturing of the polymer. The tyre manufacturers themselves cannot do this stretching-out of the polymer as it is an advanced process that calls for special equipment. On

the other hand, the tyre manufacturers add further highly aromatic oil as a softening agent in the tread. A summer tyre contains about 1 litre of HA oil.

The price of a new summer tyre is of the order of SEK 1,000 – 1,300. A retreaded summer tyre costs SEK 500 – 700.

3.4.3 HA oils in tyres for trucks, buses and trailers

As well as being used on trucks, truck tyres are used on buses weighing > 3,500 kg and on trailers. Car tyres are used for trucks and buses weighing < 3,500 kg.

The large manufacturers of truck tyres fulfil the requirements laid down for the positive Nordic ecolabel The Swan (Svanen), i.e. the tyre contains < 3 % oil subject to compulsory labelling in the tread. The tread of a truck tyre has a higher proportion of natural rubber than the tread of a car tyre. Properties such as rolling resistance, ability to withstand overheating and wear resistance are more important for truck tyres than wet grip. The admixture of HA oil in the polymers used for truck tyres is therefore lower than for car tyres, being of the order of 10-20%. A truck is fitted with 6-8 tyres. A trailer on a truck may have just as many tyres as the tractor unit.

The price of a new truck tyre is around SEK 4,000 – 6,000. The price of a retreaded truck tyre varies depending on whether the haulier presents a tyre carcasses to have the tread replaced or whether he buys a ready-retreaded tyre with both carcass and new tread. If a carcass plus new tread is purchased, the price is of the order of SEK 3,900. Without a carcass, the price is around SEK 750 lower.

3.4.4 HA oils in retreaded tyres

Today, virtually all tyres which are retreaded in Sweden, both summer and winter tyres as well as truck tyres, are free of HA oils in the tread.

2.5-3.5 kg out of a tyre weighing 7-8 kg is made up of the tread. The equivalent figures for a truck tyre are 75 kg and 10-15 kg respectively. A car tyre is regarded as being at the end of its life when the tread is worn out, but if retreading is carried out it can be used for a few more years. In retreading, the remainders of the old tread are scratched away and replaced by a new tread and new sidewalls are put on. The tyre is then vulcanised and the tread is given its new tread pattern. However, good results cannot be obtained with all makes of tyre.

The conversion to HA oil-free treads and sidewalls has been simpler for the retreading industry, as they do not supply tyres for the production of new vehicles. The production requirements are therefore less strict. The production process is also simpler as they do not manufacture the actual tyre carcass and only put on a new tread and new sidewalls.

The tyre carcasses used for retreading come almost exclusively from worn-out summer tyres. The principal reason for this is that winter tyres are usually manufactured in class Q, i.e. winter tyres are intended for speeds of up to 160 km/hour. The carcasses of summer tyres, which are adapted for higher speeds are therefore of better quality. Nor is it possible to retread studded winter tyres, as the studs would destroy the equipment when the tread is scratched off. A tyre carcass used for retreading may be no more than seven years old.

Around 800,000 retreaded car tyres are produced annually in Sweden. In addition, about 100,000 imported retreaded car tyres are sold.

Retreaded tyres altogether account for just under 20% of the Swedish market for tyres. The largest retreaders are AGI, Galaxie and Fighter, which each manufacture about 200,000 retreaded tyres a year.

A car tyre can be retreaded once, while a truck tyre can be retreaded between one and three times depending on the quality of the tyre carcass. As a result of the possibility of several retreading operations, approximately 50 – 60% of truck tyres are of retreaded tyres. A truck tyre travels 250,000 – 300,000 km before being retreaded. Every year, around 300,000 newly retreaded truck tyres are manufactured in Sweden.

The treads and sidewalls of car tyres are supplied mostly by Trelleborg/Horda, Avion, Forsheda Gummi and Nokian Tyres. Together, they meet about 90% of the need of the Swedish market. Equivalent suppliers of truck tyres are Nokian Tyres, Maragongoni, Kraiburg, Ellerbrock and Bandag.

3.4.5 Tyres other than automotive tyres

Types of tyres other than automotive tyres are tractor tyres, which account for 5% of the total number of tyres coming onto the market. Tyres for contracting machinery account for 4% of the total number, while cycle and motorcycle tyres make up less than 1% of the total tyre market. Neither Swedish-made tractor tyres nor contracting machinery contain HA oils in the tread, as wet grip is not decisively important for these vehicles.

3.5 End-of-life automotive tyres

In 1994, the tyre industry formed the tyre recycling company Svensk Däckåtervinning AB (SDAB) (The Swedish Tyre Recycling). The company was formed as a consequence of the Ordinance on Producer Responsibility for Tyres (1994:1236) and is tasked with organising the collection and recycling of all end-of-life tyres. SDAB also represents the tyre industry in its dealings with the authorities. The company is owned by the Federation of Tyre Suppliers (DF) and the National Federation of Tyre Specialists (DRF) with its Retreading Section (RS).

Since the company started in January 1995, between 90 and 100 per cent of all end-of-life tyres every year have been collected via the hundred or so collection points in Sweden. The collection and recycling rate in recent years has been virtually 100 per cent. Altogether 64,000 tonnes of tyres were scrapped in 2002, representing the estimated weight of all end-of-life tyres in the country (personal communication, Lars Åman, 2003). The areas of use for collected tyres are listed in Table 3.3.

Table 3.3 *Areas of use for collected tyres.*

Treatment	*2001 (%)*	*2002 (%)*
Retreading	5	6
Exporting of whole tyre	5	23
Exporting shredded	6	14
Re-use	1	1
Blasting mats etc.	4	5
Material recycling	31	7
Material replacement	24	12
Energy recovery CHP plants	13	9
Energy recovery cement industry	11	23
Landfills	0	0

Source: SDAB, 2003.

As the figures in the table show, material recycling decreased in 2002, and the trend is continuing in 2003. The predominant use is energy recovery. When granules and shredded rubber from end-of-life tyres are regarded as raw material, usability is primarily assessed, for example in use as road material the properties of the granules or shredded material must be such that they cope with the requirements specified for road material (personal communication, Lars Åman, 2003). Another reason for the decrease in recycling in 2002 is that the factory in Malmö, which manufactured powder and granules from end-of-life tyres burnt down in September 2001.

The majority (86 %) of exports go to the rest of Europe, mainly to Germany for recycling or retreading. Other recipient countries are Russia, the Baltic States and countries in Africa.

Type scrap is used in running tracks and as a surface for tennis courts and football pitches, but also to make rubber mats, rubber strips and fixings for road signs.

Although the trend for material recycling is downward, shredded automotive tyres have potential for recycling, in various types of facilities. Functions are frost insulation and drainage. Examples of areas of use are road material (beneath the road surface) and beneath buildings. Today, the use of end-of-life automotive tyres is only recommended in dry environments without any contact with water (personal communication, Tommy Edeskär, 2002). The National Road Administration is anxious not to create new environmental problems by using unsuitable road materials.

The building industry is interested in new materials with these functions. Processed materials such as Leca balls which for the most part are imported and are expensive are used at present (personal communication, Tommy Edeskär, 2002).

Tyres free from HA oils could increase the possibility of re-use in several large areas of use, but also reduce the health risks in present-day use, for example as swings at playgrounds in view of the fact that young children learn about different materials by biting and sucking them. Increased sale on the Swedish market would also reduce the transportation of end-of-life tyres to the continent etc.

A ban on dumping whole tyres and sorted combustible waste in landfills was introduced in Sweden on 1 January 2002[22]. Shredded tyres are classified as combustible waste, and these are consequently not allowed to be dumped in landfills either.

The EU has adopted a directive, which sets guidelines and new environmental requirements for the design of a landfill. This directive also prohibits the disposing of tyres in landfills. With effect from 1 July 2003, no whole tyres may be disposed of in landfills, and with effect from 1 July 2006 the ban also applies to shredded tyres (see also Chapter 5). The ban on landfilling may lead to increased pressure to create

[22] Ordinance (2001:512) on the Landfilling of Waste.

alternative sales markets for end-of-life tyres, which may be a step in the direction of more environmentally sound tyre material.

End-of-life tyres, on the other hand, are not classified as hazardous waste under the European Community listing of waste[23].

3.6 Automotive industry requirements for tyres

Many automotive manufactures, including the Swedish-based Volvo Car Corporation and Saab Automobile AB, have drawn up lists of chemicals, which as far as possible are to be avoided. PAHs appear on these lists. The lists are sent to all component suppliers. Volvo Car Corporation has discussed with its tyre suppliers the possibility of replacing the HA oils without the car's performance being adversely affected. Interest among the tyre manufacturers has been limited, and to date it has not been possible to produce a tyre, which meets the functional requirements. Volvo Car Corporation has received studies from Continental concerning involving tests on summer tyres containing HA oil in the tread and summer tyres with two alternative low-aromatic oils (TDAE and MES). A braking distance for a summer tyre can vary from 25 to 100 metres depending on whether the road surface is dry or wet. The braking distance for tyres with the alternative oils was 2-4% longer than for the tyres, which contained HA oil. The automotive industry cannot accept this difference from the point of view of road-traffic safety. On the other hand, winter tyres with low-aromatic oil are accepted as they do not need to fulfil the requirements specified at high speed.

Volvo Cars Sweden has urged its five tyre suppliers to draw up a plan for the development of a winter tyre bearing the Swan ecolabel, i.e. a tyre not containing any HA oil in the tread. Volvo is the country's largest tyre purchaser as a result of the purchases made by Volvo and Renault stores. Sales make up about 10 per cent of all car tyres sold in Sweden (personal communication, Anders Wahlén, November 2002).

The process of selecting and testing tyres when a new car model is developed starts around two to three years before the car is expected to be ready for production. The car manufacturer decides which type of tyre the car is to be supplied with and describes what characteristics the vehicle is to have. The specification of requirements covers such things as ride comfort, steering, stability, ice grip, wet grip, braking ability, rolling resistance and noise. The tyres must be appropriate to the characteristics of the vehicle, which means that a car which is to have type approval to

[23] Commission Decision 2001/118/EC amending the list of wastes in Decision 2000/532/EC.

cope with high speeds cannot be approved if it does not have tyres approved to meet the same requirements. If a change has been made to any part of the car after approval, e.g. the addition of a new tyre dimension, a new type approval must be applied for.

Among the 25 members of the sector organisation of the automotive industry, BIL Sweden, the four Swedish manufacturers and one of the general agents for imported vehicles have more than 200 employees. Other general agents have fewer than 200 employees.

3.7 Summary and conclusions

The phase-out of HA oils in automotive tyres can be briefly summed up as follows:

Table 3.4 *Situation regarding HA oils in automotive tyres.*

Type of tyre	*Present situation*
Winter tyres	According to the tyre industry, there are around 70 winter tyres, equivalent to around 75% of the winter tyres sold, which have a tread free of HA oil. There is greater admixture of natural rubber which is easier to blend with low-aromatic oils. The need for softening oils is not as great as for summer tyres.
Summer tyres	There is at present one summer tyre (intended for speeds up to 190 km/hour) which is free of HA oil in the whole tyre. Tests showed the tyre to have a 75-80% longer braking distance on a wet surface than on a dry surface. This is to be compared with the best tyres, where the difference was of the order of 20-25%. Volvo Car Corporation has been informed of tests on summer tyres containing HA oil in the tread and summer tyres with two alternative low-aromatic oils. A braking distance for a summer tyre can vary between 25 and 100 metres depending on whether the road surface is dry or wet. The braking distance for tyres with the alternatives was 2-4% longer on a wet road surface than for the tyres containing HA oil.
Tyres for heavy goods vehicles	The tread is free of HA oils. Approximately 50% of HGV tyres are retreaded.
Retreaded summer and winter tyres	The tread and sidewalls are free of HA oils.

As indicated by the table, summer tyres still contain HA oils, partly due to problems with wet grip, which is of vital importance to braking distance and therefore road traffic safety. Calculating on the basis that summer tyres account for around 60% of the aftermarket and that just over 1 million originally fitted tyres come onto the market through the sale of new vehicles, this is equivalent to an annual addition to the Swedish market of nearly 4 million tyres containing HA oil in the tread. On the other hand, truck tyres and retreaded tyres for cars and trucks as

well as the majority of winter tyres for cars are free of HA oils in the tread.

The requirement for type approval for passenger cars and tyres only applies to vehicles coming onto the market after 1 January 1998. The industry nevertheless considers that the majority of new tyres sold today are type-approved as several EU Member States have national requirements that only type-approved tyres may be put on the market. The same applies to truck tyres and retreaded tyres. The smaller proportion of new tyres which are not type-approved are directly imported tyres from the United States and countries in Asia, as well as a smaller number of retreaded tyres for which type approval has not yet been received. The proportion amounts to only a few per cent of the total number of tyres coming onto the market every year.

4. Alternatives to HA oils

4.1 Analytical methods for measuring the concentration of PCAs in oils

Two methods in particular can be used to detect and quantify the amount of polycyclic aromatics (PCAs) in the context of tyres, IP 346[24] and IP 391[25].

The IP 346 method is intended to determine the concentration of PCAs, which includes both PAHs and polyaromatics substituted with sulphur, nitrogen or oxygen compounds in an unused oil. This method is used to determine the part of the oil, which is more readily soluble in dimethyl sulphoxide (DMSO) than in cyclohexane. DMSO is a polar solvent, which among other things dissolves the polar polyaromatics. The result is indicated as a percentage by weight. Tests on mice show a correlation with skin cancer if the PCA concentration is higher than 3% in a DMSO extract according to the IP 346 method (Roy et al., 1988 and Berkeley et al., 1985). Reference is made to this method in the National Chemicals Inspectorate Regulations (KIFS 1994:12) on the Classification and Labelling of Chemical Products. Under the rules, oils of this type do not need to be classified as carcinogenic if it can be shown that they contain <3 % (weight/weight) of DMSO extract, measured according to analytical method IP 346.

Reference is made to this method in the criteria for the positive ecolabel, the Nordic Swan (see also 3.3.1 on ecolabelling). One of the criteria is that the concentration of PCAs in the process oil must not exceed 3%, measured according to IP 346.

IP 346 is not suitable, on the other hand, for use in checking which oil is contained in a fully vulcanised tyre. The Swedish Testing and Research Institute has therefore drawn up a combination of methods to extract and process oil from tyre rubber. The method is based on extraction from a rubber sample. The test is performed in accordance with standards ISO 1407/92[26] and ISO 4645/84[27]. Then the extract is analysed using

[24] IP 346 - Determination of polycyclic aromatics in unused lubricating base oils and asphaltene free petroleum fractions – Dimethyl sulphoxide extraction refractive index method, Institute of Petroleum, London.
[25] IP 391 - Aromatic hydrocarbons types in diesel fuels and petroleum distillates by high performance liquid chromatography with refractive detection.
[26] ISO 1407:1992 (E) Rubber – Determination of solvent extract.
[27] ISO 4645 – 1984 (E) Rubber and rubber products – Guide to the identification of antidegradants – Thin layer chromatography methods.

method IP 391, which is an HPLC[28] method for determining the concentration of PCAs in the oil contained in the tyre. If the PCA content according to IP 391 exceeds 15%, the tyre is currently assessed as containing carcinogenic oil. It is considered possible, however, to lower this limit to 10% within one year. The TDAE oil contained in the tyre today contains up to 14% PCAs, but the unused TDAE oil contains < 3 PCA according to method of measurement IP 346, which is the limit for carcinogenic classification for oils of this type. As no correlation has been made with cancer, IP 391 cannot form the basis for classification, but it can be used to check the PCA concentration.

This method is also included in the Nordic Swan criteria, to the extent that the quantity of PCAs in the tread rubber of the tyre has to be stated in accordance with method of measurement IP 391 together with standards ISO 1407 and ISO 4645.

The cost of analysing the PAH concentration of an automotive tyre according to test method IP 391 amounts to between SEK 2,500 and SEK 4,000 (Swedish Testing and Research Institute, 2003).

4.2 Alternatives to HA oils

Global production capacity for what are known as base oils at present amounts to 33 million tonnes per year. Approximately 15 million tonnes of aromatic extract are obtained from this quantity. Of these 15 million tonnes, the global tyre industry uses approximately 1 million tonnes, of which Europe uses 250,000 tonnes on an annual basis. There is excess capacity in the production of base oils in Europe today. The European producers can use the same process equipment to produce low-aromatic oils as HA oils, which is not possible in the United States. If the HA oils are processed one more step to petrol or naphthas, no residual product for which there is no market arises.

Under the EU project “EU Brite_EURAM Thematic Network on Rubber Compounding for Improvements in Health, Safety and the Environment”, a working group has evaluated some low-aromatic oils as alternatives to HA oils. Methods of measurement IP 346 and IP 391, which are described in Section 4.1, have been used in the evaluation. The results of these measurements are summarised in Table 4.1.

[28] High performance liquid chromatography.

Table 4.1 *Possible alternatives to HA oils*

Product	*Measurement according to IP 346 (PCA concentration)*[29]	*Measurement according to IP 391 (PCA concentration)*
Treated Distillate Aromatic Extract (TDAE)	1.8 – 2.5 %	9.4 – 13.9 %
Mild Extractant Solvate (MES)	0.8 – 2.2 %	5.5 – 7.1 %
Hydrotreated Paraffinic Distillate (HPD)	< 3 %	0.5 – 0.7 %
Hydrotreated Naphthenic Distillate (HND)	<3 %	4.9 %

The working group within the EU project considers it reasonable to set the limit for how much polycyclic aromatics may be present in the oil in the fully vulcanised tyre (according to method of measurement IP 391) at 10%. The reason for this assessment is that the TDAE oil can be developed so that the PCA concentration limit is below 10%. The reason why the PCA concentration becomes higher when measured by IP 391 than by IP 346 is that all the PCAs are measured and not just the most polar PCAs, as in IP 346. IP 391 is a more complete method for measuring the total PCA concentration.

According to experience gained in the western Swedish project Grön Kemi (Green Chemistry), which has performed nearly 100 analyses of oil in tyres, this correlation is in good agreement, to the extent that measured PCA concentrations above 15% according to a modified IP 391 method verified in all cases that the tyre contained HA oils.

The sector organisation of the European rubber industry, BLIC[30], has assessed a number of low-aromatic oils in cooperation with the oil industry. As well as not being harmful to health or the environment, the requirement of being capable of being produced in sufficient quantities to meet the needs of the European market must be met. The alternative oils must also be compatible with the usual rubber blends and not mean that large investments have to be made in the refineries to produce them. The BLIC criteria for a low-aromatic oil are listed in Table 4.2.

[29] Polycyclic aromatic hydrocarbons including polyaromatics substituted with sulphur, nitrogen or oxygen compounds.
[30] Bureau de Liaison des Industries du Caoutchouc de l'U.E.

Table 4.2 *BLIC criteria for a low-aromatic oil.*

• *IP 346 (DMSO extract < 3 %)*
• May contain no more than 10 mg/kg of any of the following PAHs: - benzo(a)pyrene - benzo(e)pyrene - benzo(a)anthracene - benzo(b)fluoranthene - benzo(j)fluoranthene - benzo(k)fluoranthene - dibenzo(a,h) anthracene - chrysene
• May contain no more than a total of 50 mg/kg of the above PAHs
• Ames test[31] must prove negative
• Availability on the market

According to BLIC it is principally TDAE and MES that fulfil the requirements set, see also Table 4.3.

Table 4.3 *BLIC's assessment of the availability of low-aromatic oils*

Oil	*North America*	*Europe*	*Asia*
TDAE [1)]	-	+-	+-
MES [2)]	+-	+	-
Naphthenic oil	+	-	+-

1) Treated Distillate Aromatic Extract
2) Mild Extraction Solvate
+ = sufficient to meet market needs.
- = not sufficient to meet market needs.
+- = uncertain whether market needs can be met.

The German Federal Environmental Protection Agency, Umweltbundesamt (UBA), has learnt from its contacts with European oil producers that increasing the production of low-aromatic oils, if the demand for them rises does not pose any problems (personal contact, Axel Friedrich, UBA 2002).

[31] A method which can detect whether a chemical substance can give rise to genetic changes.

The technique for producing base oils, where the aromatic hydrocarbon compounds are washed out with solvent, leaving a highly aromatic extract as a by-product, is on the way to disappearing, to be partly replaced by a technique based on hydration, where the double bonds in the aromatic hydrocarbons are split using hydrogen gas. This process produces low-aromatic oils, which are not classified as carcinogenic.

A substitution to oils, which are not classified as carcinogenic reduces the release of polycyclic aromatic hydrocarbons from tyre wear by 98% (Null, 1999).

A change of oil may lead to a change in the properties of the rubber blends and therefore the oil. It means that material development work must be carried out in the rubber industry before low-aromatic oils can be fully put to use, not least in view of the need for important properties such as the wet grip of the tyre not to be adversely affected.

The costs associated with a substitution to a low-aromatic oil are costs for the development of the rubber polymer, conversion of processes in tyre manufacturing and tests both in the laboratory and in the field. The industry estimates that it will take two to three years to carry out the necessary tests. As further steps are required in the refining process to produce a low-aromatic oil, the oil will also become a few SEK more expensive. The increase in cost for European manufacturers is estimated at just over SEK 600 million (60 million US dollars). Translated to cost per tyre, it is estimated that this will be SEK 1.50 – 4 higher, depending solely on the higher oil price. Figures for the increase in price when it reaches the end-customer vary. Nokian Tyres estimates that the price per tyre will increase by 1 euro, i.e. about SEK 10, while other tyre manufacturers believe that the price difference will become greater if more extensive development of the rubber polymer is required to make it compatible with a low-aromatic oil. The oil companies claim, however, that rolling resistance will be reduced with the alternatives MES and TDAE, which can result in lower costs for fuel consumption (UBA, 2002), which can offset the higher cost of the tyre.

The stages in the production of the low-aromatic oils MES and TDAE are shown in **Annex 2**.

5. Ongoing activities

5.1 National activities

5.1.1 SIS Swan Ecolabelling

The Nordic "Swan" positive ecollabelling scheme is the only ecolabelling for automotive tyres in Sweden. The Swan criteria for car tyres were ready in June 1999, but it was not until October 2001 that the first five licences were issued. Five retreaders each received a Swan licence. In November 2002, two winter tyres manufactured by Kumho in South Korea gained the first licences for newly manufactured tyres. Tyres made by Kumho for buses and trucks are also on the way to qualifying for a Swan licence. Kumho is the tenth largest tyre manufacturer in the world.

The development of criteria for automotive tyres began following pressure from tyre manufacturers and purchasers. The Swan assesses the environmental impact of tyres from raw material to waste and specifies requirements for where the impact is greatest. The requirements of the Swan have been developed in consultation with Nordic tyre experts, both retreaders and manufacturers of new tyres. The requirements include:

- No HA oils in the tread
- Limited content of heavy metals
- Rolling resistance
- Noise
- Wet grip
- Sorting at source in manufacturing

The target is for 30% of the market to fulfil the requirements. When the target has been attained, the requirements are raised through the step-by-step development of criteria.

The application fee is SEK 15,000. When the licence is granted, there is an additional annual fee of 0.3% of the company's turnover from the licensed product.

For a tyre to be allowed to be labelled with the Nordic Swan, it must also meet the requirements for rolling resistance, noise, friction properties and durability.

5.1.2 Swedish Consumer Agency

In a letter to the Swedish Consumer Agency, the Green Party of Sweden has reported a number of tyre companies for marketing tyres without providing the information that they contain HA oils. This information is important for consumers who want to be able to make purchases based on correct information on what the environmental consequences of different choices will be.

The Swedish Consumer Agency will be contacting the tyre industry to discuss marketing and the presence of HA oils in automotive tyres, as well as the alternatives to these oils. The aim is to reach an agreement on voluntarily providing comprehensive information in marketing.

5.1.3 Environmental requirements in procurement

Several local authorities, county councils but also private companies today specify requirements to be met by tyres equivalent to the Swan requirements in their procurement. Some examples are given below.

The logistics company Schenker AB (formerly Bilspedition) has annual turnover of SEK 9 billion and has about 7,000 load carriers in circulation. The contractors who drive for Schenker AB must sign a contract. When Swan labelled truck tyres are available on the market, Schenker AB will require such tyres to be used. A requirement, which already exists is that from 2002 all newly purchased tyres must be free of HA oils in the tread.

Folksam, an insurance company, requires hire-car companies they cooperate with to have winter tyres with treads, which do not contain any HA oils.

The public sector annually procures large quantities of tyres for cars, trucks and buses. Transport services are also procured on a large scale. By specifying requirements for environmental soundness of tyres, the public sector can be a significant player in increasing the demand for environmentally sound tyres and consequently contribute to an increase in the supply of such tyres on the market.

The Department for Procurement, located at the Swedish Agency for Public Management with effect from 1 January 2003, coordinates the common state framework contracts through which government agencies have to be able to purchase goods and services on more advantageous terms than each agency can on its own. Nine agencies with responsibility for framework contracts are currently at work on analysing the basic requirements to be met for framework contracts in different product areas. Swedish Armed Forces Logistics is responsible among other things

for signing framework contracts for automotive tyres. The value of tyre procurement amounts to SEK 34 million per year. The aspiration is for the framework contracts to be prominent in the specification of environmental requirements in procurement. The EKU tool is therefore used to support the work of signing framework contracts[32]. The government agencies will be able to use a new framework contract in the procurement of tyres from 1 July 2003.[33] The aspiration of Armed Forces Logistics is for the new framework contract to enable the procuring agencies to choose tyres with a tread containing no HA oils through mandatory requirements for the suppliers' ranges of car tyres and tyres for trucks and buses to include tyres with treads free of oils classified as carcinogenic or environmentally hazardous under the EU's classification and labelling directive 67/548/EEC. This requirement covers HA oils.

The Committee for Ecologically Sustainable Procurement (1998-2001)[34] has devised an Internet-based tool (the EKU tool) for ecologically sustainable procurement. This tool can be used as an aid by the public organisations in taking account of the environment in the procurement of goods, services and contracting. The tool contains proposals for environmental requirements, which can be stipulated for different product groups, including tyres.

The specification of environmental requirements for tyres in the EKU tool indicates as a mandatory requirement that "the tread rubber in car tyres and tyres for trucks and buses must be free of oil subject to a duty of labelling under the EU classification and labelling directive 67/548/EEC. This shall be verified for example by the tread having been checked by method of measurement IP391 and the PCA concentration having been found be below 15 per cent."

It may be mentioned as an example of an individual procuring unit which stipulates environmental requirements in the procurement of automotive tyres that the Västra Götaland Region in its procurements of leased vehicles specifies requirements that only tyres which do not contain any HA oils in the tread may be used.

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[32] Co-ordination of government procurement www.avropa.nu.
[33] Ordinance (1998:796) on Co-ordination of Government Procurement covers authorities under the government, i.e. the civil authorities, the armed forces and public enterprises.
[34] The Committee for Ecologically Sustainable Procurement, appointed by the Government with the task of pressing for public procurement to be an instrument with which to bring about ecologically sustainable development.

5.1.4 Green Chemistry project

The Green Chemistry (Grön Kemi) project, which is a co-operative project involving Västra Götaland County Administration, the Göteborg Region Association of Local Authorities and Business Region Göteborg, has drawn up lists of both winter and summer tyres which do not contain any HA oils in the tread. The lists are based on analyses made according to the analytical method developed by the Swedish Testing and Research Institute to measure the concentration of polycyclic aromatic hydrocarbons in fully vulcanised rubber, which is described in Chapter 4. The lists comprise car tyres, which are on the Swedish market and have been drawn up in co-operation with the insurance company Folksam. The lists can be found on the websites of Grön Kemi and Folksam[35].

5.1.5 Producer responsibility and waste

Sweden has introduced rules on producer responsibility for tyres through the Ordinance on Producer Responsibility (1994:1236). According to the provisions of this Ordinance, at least 80% of all tyres returned annually must be disposed of in some way other than by landfilling.

In Sweden, a ban on disposing of whole tyres and sorted combustible waste in landfills was introduced[36]. Shredded tyres are classified as combustible waste, and these are therefore not allowed to be placed in landfills either. The Swedish ban relating to combustible waste is more far-reaching than the Community Directive on landfilling (see 5.2.4).

5.1.6 Working environment

Benzo(a)pyrene, which is contained in HA oils, is included in the Swedish Work Environment Authority list of occupational exposure limit values[37]. The threshold limit value, i.e. the limit value for exposure during the working day, is 0.002mg/m^3.

5.2 Activities within the EU

5.2.1 The EU's new policy on chemicals – the REACH system

In 2001, the Commission presented a draft strategy for future policy on chemicals in the Community (COM(2001)88 final). A new system for inspection of chemicals is to be introduced, known as the REACH system

[35] www.gronkemi.nu and www.folksam.se.

[36] Ordinance (2001:512) on Landfilling of Waste.

[37] National Board of Occupational Safety and Health Regulations (AFS 2000:3) on occupational exposure limit values and measures to combat air pollution.

(Registration, Evaluation and Authorisation of Chemicals). All chemical substances manufactured in or imported into the EU above a particular quantity have to be registered and evaluated in terms of risk by the manufacturer/importer, or in certain cases by the user (if the use is different than that included in the calculation made by the manufacturer/importer in its evaluation).

In addition, substances which have particularly hazardous properties and cause particular concern are to be successively covered by an approval procedure at EU level. As the proposal stands at present, substances, which are carcinogenic, mutagenic or toxic to reproduction (CMR substances categories 1 and 2) will be covered, as well as substances with POP-like properties (Persistent Organic Pollutants). Sweden is pressing for substances, which are persistent and bioaccumulative to be covered as well. However, this necessitates criteria for these properties being established at EU level.

Substances, which fall within the criteria, will only be approved for use in specific circumstances. Several PAHs which are contained in HA oils are classified as category 2 carcinogens and will therefore be covered by an approval procedure. Among the circumstances primarily to be taken into account are if the exposure/risk is negligible, the availability of alternatives and the socio-economic consequences of whether approval is granted or not.

The approval procedure will probably cover use in products, including those imported into an EU Member State from a third country.

The Commission intends to submit legislative proposals on how the new policy on chemicals is to be formulated in the spring of 2003.

5.2.2 The water framework directive

The aim of the water framework directive (Directive 2000/60/EC) is to ensure good ecological water status. The Directive covers both surface waters (lakes, watercourses, coastal waters) and groundwater.

Under the Directive, the European Parliament and Council are to adopt specific measures against pollution of water. The measures are to be aimed at progressive reduction. Discharges, emissions and losses of priority substances are to cease or be phased out within twenty years. The measures are to be adopted on the basis of the proposals submitted by the Commission.

A list of "priority substances in the area of water policy" has been established for the framework directive (Decision no. 2455/2001/EC). The substances in the list have been chosen on the basis of the risk they present to or via the aquatic environment. The priority substances are a group comprising a total of 33 compounds. They have been divided into sub-groups depending on the extent to which they can present a risk. The three groups are priority hazardous substances, priority substances and potentially hazardous substances. The hazardousness of substances on the basis of the best available knowledge has been taken into account. In establishing these priority substances, great emphasis has been put on available hazard assessments, particularly from the work carried out within the OSPAR strategy and the UN-ECE Convention on Long-Range Transboundary Air Pollution.

In identifying priority substances, account was taken of whether the substance could be classified as being **toxic, persistent and liable to bioaccumulate** or having similar properties. The eleven substances identified include polycyclic aromatic hydrocarbons. Most PAHs are toxic, persistent and have the ability to bioaccumulate. The properties can differ between different substances in this group. As a sub-group of PAHs, there are also:

- benzo(a)pyrene
- benzo(b)fluoranthne
- indeno(1,2,3-cd)pyrene
- benzo(g,h,i)perylene.

All of these PAHs may be contained in HA oils.

5.2.3 Ambient air quality assessment and management

The fifth environmental action programme (1992)[38] contains recommendations on setting long-term targets for air quality. These recommendations are put into practical form in Directive 96/62/EC on Ambient Air Quality and Assessment. The aim of the Directive is to:

- define and establish objectives for ambient air quality in the Community designed to avoid, prevent or reduce harmful effects on human health and the environment as a whole,

[38] At regular intervals, the European Commission draws up an environmental action programme containing guidelines for EU environmental policy. The programme is adopted by the Council of Europe. An environmental action programme is not binding, but has a governing effect as the Member States have backed it at the highest level. The fifth environmental action programme contains a number of targets to be met by 2000. Negotiations are currently in progress on a sixth environmental action programme.

- assessment of the ambient air quality in Member States on the basis of common methods and criteria
- obtain adequate information on ambient air quality and ensure that it is made available to the public.

Under the Directive, the Commission is to submit to the Council proposals for the setting of limit values and alert thresholds for the air pollutants listed in an annex. Polycyclic aromatic hydrocarbons are included in this list. According to the Directive, a proposal for a limit value for PAHs should be submitted by the end of 1999. The work in the EU has, however, been delayed. According to information from the Swedish Environmental Protection Agency, the Commission is preparing a proposal for a limit value for benzo(a)pyrene as an indicator substance for PAHs. Benzo(a)pyrene is contained in HA oils. As indicated earlier (Chapter 2.5), however, HA oils from tyre wear are unlikely to make a major contribution to human exposure to PAHs.

When a limit value has been established, the Member States have to take the necessary measures to ensure that the limit value is respected. The Member States also have to draw up action plans for what measures are to be taken if limit values/alert thresholds are exceeded. If the limit values or alert thresholds are exceeded, the public has to be informed accordingly and the Commission notified.

5.2.4 Waste and landfilling

Council Directive 1999/31/EC lays down guidelines and new environmental requirements in the design of a landfill. The landfilling of tyres is prohibited in this Directive. With effect from 1 July 2003, no complete tyres may be disposed of in landfills, and from 1 July 2006 the ban also applies to shredded tyres. Exceptions are cycle tyres and tyres which have a diameter in excess of 1,400 millimetres.

Used tyres, on the other hand, are not classified as hazardous waste under Commission Decision 2001/118/EC amending Decision 2000/532/EC as regards the list of wastes.

5.3 Activities in some individual European countries

5.3.1 Germany

The German Environmental Protection Agency, Umweltbundesamt (UBA), has drawn up documentation for a proposal for an EU-wide ban on HA oils in automotive tyres. The UBA presented the proposal to the Commission at the end of February 2003. The German proposal entails a

ban on HA oils in all types of automotive tyres from 1 January 2006. The UBA documentation also contains a list of twelve individual PAHs. For an oil to be regarded as low-aromatic, the total concentration limit for the twelve PAHs must not exceed 10 ppm. The concentration limit for benzo(a)pyrene must not exceed 1 ppm. A DIN standard will be drawn up to enable these low concentrations of PAHs in the oil to be measured. The UBA welcomes co-operation with Sweden on this matter (personal communication, Anette Rauterberg-Wulff, UBA, December 2002 and Axel Friedrich, UBA, 2003). Before the UBA drew up a proposal for a ban, they discussed the issues with BLIC, and in a letter urged them to replace the HA oils voluntarily.

Some European car-makers have shown an interest in tyres made with alternative oils. In 1998, the German industry organisation for car-makers[39] published a new specification which allows softening oils in tyres to contain no more than 1 ppm benzo(a)pyrene[40] .

5.3.2 Austria

Austria does not have any activities directed towards HA oils in car tyres at present, but has drawn attention to PAHs in other contexts.

Austria has notified a ban with effect from 1 March 2003 on manufacturing and placing on the market clay pigeons (for shooting) with a PAH concentration in relation to the dry substance exceeding 10 mg/kg. The proposal also includes a ban on the use of such clay pigeons after 1 September 2003.

The reason for the proposal is that shards and finely crushed material from clay pigeons lead to the direct dispersal of PAHs to the environment when the clay pigeon is fragmented at the firing range. PAHs have already been detected in a number of environmental media, such as aquatic systems, sediments, soil, sewage sludge and in plants.

It is also stated in the documentation that humans are exposed primarily through direct inhalation of churned-up ground particles from polluted ground, through the ingestion of contaminated food and through skin contact with contaminated soil or objects.

With effect from 6 December 2002, it is permitted for Austria to apply the proposed restriction on PAHs in clay pigeons.

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[39] VDA (Verband Deutscher Automobilhersteller)
www.mdsystem.com/html/en/home_en.htm
[40] www.mdsystem.com.

There are also equivalent restrictions in the Netherlands and Germany.

5.3.3 Norway

The Environmental Home Guard (Miljøheimvernet) is a form of co-operation between 18 voluntary organisations in the environmental area. The aim of their work is to provide practical tips on environmental sound alternatives and solutions both for the public and for local authorities, organisations and companies.

The Environmental Home Guard proposes that the Norwegian Pollution Control Authority should:

- Support the work of Swedish authorities in obtaining a ban on HA oils within the whole EC/EEA.
- Investigate safety when automotive tyres and other products made from automotive tyres are used on playgrounds etc. A study to establish which chemicals are emitted from car tyres is proposed in view of the fact that children both suck and bite the tyres.
- Require the industry to implement changes in production so that the smallest possible concentration of HA oil is formed and the industry finds another and safer end-use for HA oils than mixing them into automotive tyres.

(Personal communication, Jon Bjartnes, 2002)[41].

5.4 Activities in European industry

5.4.1 BLIC

BLIC is the sector organisation for the European rubber industry, and its members include tyre manufacturers. A working group comprising Bridgestone/Firestone Europe, Continental Cooper-Avon, Goodyear Dunlop Tires, Michelin, Nokian, Pirelli and Vredestein began in 1995. The aim of the group is to develop technical specifications and solutions to be able to replace HA oils in all new types of tyres for cars, trucks and buses. An important requirement is that road traffic safety must not be jeopardised. The publication of KemI report 6/94 “Nya hjulspår” (New Wheel Tracks) was one of the reasons why the group started its work.

[41] The letter can be found at www.gronnguide.no).

BLIC considers that the use of HA oils may have ceased by 2008 in all new types of automotive tyres. Within this period of time, BLIC considers that all the links in the chain: oil producers, polymer manufacturers, tyre manufacturers and vehicle manufacturers, will cope with the substitution to low-aromatic oils, but that there is a need for statutory requirements at EU level to ensure that the change-over is implemented. The reason is that a ban affects all suppliers equally including those outside Europe. This view has been put to the Commission. BLIC is also looking for an EU-standardised test method capable of verifying that a tyre is free of HA oil.

5.5 International activities

5.5.1 The Helsinki Convention

The objective of the Convention (1992) is to protect the marine environment in the Baltic Sea from pollution. The Helsinki Commission, HELCOM, is the Convention's executive body, whose tasks include proposing measures related to the aims of the Convention. The goal is for concentrations in the environment in 2020 to be close to the background level for naturally occurring pollutants and virtually non-existent for synthetic compounds.

A list of 42 hazardous compounds which can harm the ecosystem and human health have been chosen as being of top priority for immediate action. These compounds are **toxic, potentially bioaccumulative and persistent** or cause concern in some other way. This group includes pesticides, metallic compounds and industrial compounds. PAHs appear in the list as a group of compounds to be restricted.

5.5.2 OSPAR

The objective of the OSPAR[42] Convention is to protect the marine environment in the North-East Atlantic. In 1998, OSPA adopted a strategy for hazardous substances. A list, "*OSPAR List of Substances for Priority Action"* was drawn up. Discharges are to be continuously reduced for those substances, which feature in the list.

PAHs are included in the OSPAR list of chemicals for priority action within UNECE POP. The compounds were identified by OSPAR as being of concern during the period 1991-1997 and are part of the OSPAR

[42] The Convention for the Protection of the Marine Environment of the North-East Atlantic

programme of work. PAHs are also listed among the compounds regarded as being potential endocrine disrupters.

5.5.3 Convention on Long-Range Transboundary Air Pollution (CLRTAP)

The Convention on Long-Range Transboundary Air Pollution contains a total of eight protocols.

One of the protocols, Århus 1998, dealt with persistent organic pollutants (POPs). These are substances, which have **toxic properties, are persistent, bioaccumulative** and can cause adverse events on human health and the environment, near to or far from the source of discharge. Once these pollutants have been released into the environment, they will remain there and pose a threat to living organisms for a long time to come.

Sixteen substances are identified in this protocol, eleven of them being pesticides. PAHs are identified with aim of sharply reducing discharges and emissions so that concentrations fall below 1990 levels. Indicator compounds will be used during the cataloguing of emissions. Three of these are benzo(a)pyrene, benzo(b)fluoranthene and indeno(1,2,3-cd)pyrene, which may be present in HA oils.

6. Legal analysis

6.1 Introduction

At Community level, there are rules in place to limit the use and sale of chemicals in the restrictions directive[43]. The directive relating to end-of-life vehicles[44] prohibits the use of certain chemical products in components and materials for motor vehicles. Rules relating to tyres can be found in the directive on tyres[45]. The tyre directive does not include any requirements relating to the chemical content of tyres.

Provisions on chemicals can be found in the Environmental Code and subsequent legal provisions. The Motor Vehicle Ordinance and regulations issued by the Swedish National Road Administration regulate vehicles and tyres.

Sections 6.2-6.3 deal more closely with these and a number of other rules. Section 6.4 contains a summary of the options available for regulating highly aromatic extracts at EC level or national level.

6.2 Current rules at Community level

The scope of any Swedish ban is limited primarily by EC rules governing type-approved motor vehicles and tyres. Details of these directives and their effect on national regulations are set out below.
This section also deals with other EC directives in this area.

6.2.1 Type-approved motor vehicles and tyres

Rules governing type-approval can be found in the framework directive on type-approved motor vehicles[46] and in the special directive on tyres. The former directive regulates a Community type-approval procedure for

[43] Council directive 76/769/EEC of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations.
[44] Directive 2000/53/EC of the European Parliament and of the Council of 18 September 2000 on end-of-life vehicles.
[45] Council directive 92/23/EEC of 31 March 1992 relating to tyres for motor vehicles and their trailers and to their fitting.
[46] Council directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers (revised by for example 92/53/EEC).

vehicles and components in line with the requirements set out in special directives such as the special directive on tyres. At UN level, there are various regulations relating to vehicles and tyres (Economic Commission for Europe, ECE regulations 30, 54, 108 and 109[47]). According to the directive on type-approved motor vehicles[48], approval in accordance with these rules is equivalent to that granted on the basis of the requirements set out in a special directive These rules are generally applied at present rather than the special directive on tyres. It is however felt that the situation will be different in a few years' time.

In the directive on type-approved motor vehicles[49], it is stated that by 1 January 1998, all new private cars will need to be EC type-approved[50] before they are placed on the market. This means that there are no type-approval requirements in place for older cars or for vehicles other than private cars, e.g. trucks and buses. Type-approved vehicles must continue to be fitted with type-approved tyres. This means that replacement tyres for such vehicles will always need to be type-approved. Tyres must meet certain technical requirements set out in the tyre directive and be approved in accordance with this directive.

Type-approval is the procedure by which a Member State certifies that a type of vehicle meets the technical requirements set out in a special directive and the control requirements set out in a type-approval certificate (annex to directive on type-approved motor vehicles). Approval covers a well-defined type of product. Type-approval is granted by an authority responsible for such matters in place in every Member State. In Sweden, it is the Swedish National Road Administration that is responsible for such matters. A type-approval application is filed with the Swedish National Road Administration, the vehicle and tyres are tested by an accredited laboratory, approved by the Swedish National Road Administration and the vehicle manufacturer carries out his own checks. The manufacturer of a type-approved vehicle will then issue a certificate of conformity, which will accompany each vehicle manufactured in accordance with the type-approval. The manufacturer will also mark each vehicle manufactured with the number allocated to that type of vehicle. Type-approval granted in one country is valid throughout the

[47] Attached 1958 agreement on the adoption of uniform rules governing type-approval of equipment and parts for motor vehicles and mutual recognition of such approval.
[48] See amendment 92/53/EEC, annex 4.
[49] See amendment 92/53/EEC.
[50] National requirements on type-approval are set out in the Swedish National Road Administration regulation (VVFS 1994: 5, revised VVFS 1999: 178) governing cars and trailers and other vehicles towed by cars.

Community. Member States may not prohibit or restrict the marketing of type-approved vehicles. There are exceptions but only in the case of a direct risk to traffic.

6.2.2 The restrictions directive

The restrictions directive[51] contains harmonized rules in areas where unanimity is advised in order to protect the environment and human health. The aim of the directive is to stop national regulations preventing action and affecting the establishment and functioning of the common market.

The directive specifies what chemical substances and preparations should be restricted and in what way. Member States must take any action necessary to ensure that the dangerous substances and preparations named in the annex are only placed on the market and used in accordance with the terms and conditions specified therein. Provisions on restrictions arising from the directive can be found chiefly in the National Chemicals Inspectorate's Chemical Products and Biotechnical Organisms Regulation (KIFS 1998: 8).

6.2.3 Directive on end-of-life vehicles

The directive on end-of-life vehicles aims to limit the impact of end-of-life vehicles on the environment and thereby help to protect, preserve and improve the quality of the environment. It seeks to achieve increased recycling of end-of-life vehicles, make manufacturers responsible for recycling and bring about the introduction of incentives to design products that are easier to recycle. The directive relates to the entire car, including the tyres.

Article 2 of the directive defines vehicles as vehicles in accordance with the directive on type-approved vehicles and preventive measures as measures aimed at limiting the quantity of end-of-life vehicles and the damage they cause to the environment. Dangerous substances are defined as substances considered to be dangerous under the terms of the directive relating to the classification, packaging and labelling of dangerous substances[52].

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[51] Council directive 76/769/EEC of 27 July 1976 on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations.

[52] Council directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances.

In Article 4.1 of the directive, it is stated that Member States must encourage vehicle manufacturers to act in concert with manufacturers of materials and equipment to restrict the use of dangerous substances in vehicles and to limit the use of such substances as far as possible starting at the design stage. According to Article 4.2a, Member States must ensure that materials and components of vehicles placed on the market after 1 July 2003 do not contain lead, mercury, cadmium or hexavalent chromium (except in certain cases as specified in the annex). According to Article 3, the directive covers both vehicles and end-of-life vehicles - including their components and materials. According to Article 3.2, the directive shall not affect application of existing Community legislation - particularly with regard to safety standards.

6.3 National regulations

There are currently no regulations banning the use of highly aromatic extracts in automotive tyres. New regulations must therefore be introduced. This section deals with the Environmental Code's rules of discretion and provisions relating to duty of information together with Swedish provisions on manufacturer liability and regulations governing vehicles and tyres.

The Environmental Code's rules of consideration do not represent a general ban on dangerous chemical substances but should be seen as provisions to be applied in each individual instance. The framework for application of the regulations can be found in Chapt. 2 Sect. 7 Environmental Code. Measures must be justified and reasonable. The cost-benefit ratio must be considered in particular. The general rules of consideration set out in Chapt. 2 do not therefore signify a ban on highly aromatic extracts in automotive tyres.

Duty of information does of course cover goods, including tyres for example. Tyre information requirements ought to be laid down in special regulations although a ban would be far more effective in preventing highly aromatic extracts in tyres than information requirements. A duty of information as sole instrument of control would not be sufficient in this connection. On the other hand, regulations governing duty of information would increase consumer awareness. This in turn should increase pressure on the companies concerned and might speed up the replacement of highly aromatic extracts. A ban might therefore be supplemented with regulations governing information requirements.

Swedish regulations governing manufacturer liability do not impose any requirements on the design of tyres but stipulate only that they must be produced in an environmentally sound and approved manner and that the volume of waste should be kept to a minimum.

Neither does vehicle legislation contain any requirements governing the chemical content of tyres.

These provisions are examined more closely below.

6.3.1 The Environmental Code's general rules of consideration

According to Sect. 2 Chapt.1 Environmental Code, anyone who runs or intends to run a business or take some action must prove that the obligations arising from the provisions set out in that section are met. The burden of proof that regulations have been applied rests with the operator.

In Sect. 3 of this same chapter, it is stated that the operator must take preventive action, observe restrictions and take any other precautions necessary to stop, prevent or deter the business or action from damaging or having an adverse effect on the environment or human health. Precautions must be taken as soon as there is reason to believe that a business or action may damage or have an adverse effect[53] on the environment or human health. Each situation needs to be assessed separately taking into account individual circumstances. Justification checks will need to be carried out in accordance with Chapt. 2 Sect.7 (see below).

According to Chapt. 2 Sect. 6, an operator must avoid using or selling any chemical product that might be seen as representing a risk to the environment or human health (principle of product selection) if it can be replaced by one that is regarded as less harmful. This applies also to goods that contain or have been treated with chemical products of this kind. Any assessment should take into account the inherent properties of the product or goods - irrespective of any precautions and safety measures already taken.

The principle of product selection applies in instances where a less harmful alternative is available. An assessment is made in each individual case. The principle of product selection means that permitted harmful

[53] An adverse effect on human health means any effect which according to medical judgement or from the point of view of hygiene may be deemed detrimental to health and is not minor or totally incidental (Sect. 9 Art. 3 Environment Code).

substances and preparations must be avoided or replaced. Anyone who uses a chemical product should assess whether or not they can achieve the same result with a different product that is less harmful or totally harmless. As part of the assessment process, the precautionary principle must be applied so that the result does not just depend on the degree of harm but also any risks involved. The framework for application of the principle of product selection is set out in Chapt. 2 Sect. 7 (see below).

Based on the general rules of consideration, any business or action that may affect the environment or human health will therefore need to be conducted or taken in such a way as to prevent or limit adverse effects. The provisions give details of what needs to be taken into account in particular to achieve this. They must however be applied in such a way as not to place unreasonable demands on the operator in terms of efficiency or costs. There will be a point where the marginal benefit does not outweigh the costs involved. The point where this occurs is regulated in Sect. 7. According to this provision, the need for consideration will only apply if fulfilment is not deemed unreasonable. The particular benefit of safety measures and other precautionary action compared with the costs involved must be taken into account. The provision therefore implies that costs arising from the rules of consideration must be justified. Measures should not be unreasonable compared with the costs involved. It is up to the operator to prove that the costs involved in taking some action are not environmentally motivated or unreasonably burdensome. The degree of urgency depends on amongst other things the level of risk.

6.3.2 Duty of information

Regulations governing duty of information are set out in the Environmental Code (1998: 808) and The Chemical Products and Biotechnical Organisms Ordinance (1991:941). According to Chapt. 14 Sect. 8 Environment Code, anyone who manufactures, imports into Sweden or places on the market a chemical product or biotechnological organism must through labelling or by some other means provide the information required to protect the environment or human health. According to Sect. 3 Para. 1 of the Ordinance, the Chemicals Inspectorate may issue an instruction to the effect that the provisions on duty of information will apply also to goods that contain a chemical product and may on the basis of their properties be deemed to constitute a risk to the environment or human health. According to Para. 2 of the said section, duty of information will apply to those who handle or import goods such as tyres into Sweden on a commercial basis even if such regulation has not been issued.

6.3.3 Manufacturer liability

In a regulation relating to manufacturer liability for tyres (1994: 1236), Sweden has introduced rules governing manufacturer liability for tyres. According to these provisions, at least 80 % of all tyres returned each year must be disposed of in some way other than through controlled tipping.

Manufacturer liability for cars has been regulated in the regulation relating to manufacturer liability for end-of life vehicles (1997:788). This applies to light vehicles with a total weight of up to 3,500 kg. The manufacturer is responsible for the entire car, including the tyres. To avoid double manufacturer liability, the tyre regulation contains a reference to manufacturer liability for cars.

6.3.4 Vehicle legislation

The Motor Vehicle Ordinance (1972: 595) covers a vehicle's quality and equipment. Based on the said order, the Swedish National Road Administration has issued regulations governing vehicle and tyre requirements[54]. These incorporate both national requirements and EC legal provisions. The Swedish National Road Administration regulation (VVFS 1994: 5, revised VVFS 1999: 1789) governing cars and trailers and other vehicles towed by cars contains provisions on both type-approved and non-type-approved vehicles and tyres.

6.3.5 Authorization

The Motor Vehicle Ordinance (1972: 595) sets out rules governing a vehicle's quality and equipment and vehicle checks. According to Sect. 7 Motor Vehicle Ordinance, vehicles may only be used on the roads if they are reliable from a safety point of view and are suitable for use on the roads. Art. 102 Motor Vehicle Ordinance authorizes the Swedish National Road Administration to issue regulations governing vehicle quality and equipment. The latter may therefore require certain equipment to be labelled or of a type approved by the board, Administration or some other authority. In accordance with Art. 103 Motor Vehicle Ordinance, the Swedish National Road Administration may prohibit a vehicle from being fitted with parts or accessories that increase the risk of injury in road traffic accidents, reduce road safety in some other way or represent some other significant risk. The Swedish National Road Administration may also stipulate that certain vehicle components or accessories may only be used if they are labelled in accordance with Swedish National Road Administration regulations or

[54] Swedish National Road Administration regulation (VVFS 1994: 5, revised VVFS 1999: 178) governing cars and trailers and other vehicles towed by cars.

are of a type approved by the Swedish National Road Administration or some other authority.

According to Chapt. 14 Sect.1 Para. 2 Environmental Code, the government or the authority appointed by the government may stipulate that the Code's provisions on chemical products should apply also to goods that contain such a product if by reason of their properties goods may be deemed harmful to the environment or human health. In line with Sect. 14 Sect. 24 Environmental Code, the government or the authority appointed by the government may also issue regulations relating to the handling, import and export of chemical products. If of particular importance for health or environmental reasons, the government or the authority appointed by the government may ban the handling, import or export of a chemical product (Chapt. 14 Sect. 25 Environmental Code). In the regulation (1998: 941) governing chemical products and biotechnological organisms, the Chemicals Inspectorate has been authorized to issue regulations governing for example product information in accordance with Chapt. 14 Sect. 8 Environmental Code. The Inspectorate may also issue regulations to the effect that certain provisions of the Environmental Code, such as those on duty of information, will apply also to goods. The Chemicals Inspectorate does not however have any authority to issue bans in accordance with Chapt. 14 Sect. 25 Environmental Code - except for bans arising from EC legal acts such as the restrictions directive (Art. 24 of the Ordinance). According to Sect. 21 of the Ordinance, the Inspectorate may also lay down special terms and conditions governing the handling, import and export of chemical products.

6.4 Scope of a Swedish ban

In accordance with the directive relating to type-approved motor vehicles, no Member State may refuse to register a new vehicle or prohibit it from being marketed, taken into use or used for purposes appropriate to its design or function if it is accompanied by a certificate of conformity. According to a ruling given by the EC court in case C-329/95[55], the directive relating to motor vehicles[56] must be interpreted in such a way that it prevents national regulations that state that motor vehicles with valid Community certificates need national certificates confirming that they meet national exhaust cleaning requirements in order to be registered.

[55] The court's ruling (fifth division) dated 29 May 1997.
[56] Wording of directive 92/53/EEC

The directive relating to type-approved vehicles (including tyres) therefore implies that a Swedish ban cannot prevent type-approved tyres with highly aromatic extracts being placed on the market. This does not however apply to tyres not covered by the requirement that they must be type-approved. As stated above, tyres for private cars registered before 1 January 1998 and tyres for vehicles other than private cars do not need to be type-approved. This is the case also for certain replacement tyres. Such tyres might therefore be covered by a Swedish ban.

It should also be mentioned that requirements governing type-approved tyres will also apply to new trucks and buses with effect from 1 January 2005. Retreads will also need to be type-approved. This is stated in ECE regulations 108 and 109 approved by the Community. These regulations require the states concerned to introduce relevant requirements. Swedish regulations will be issued by the Swedish National Road Administration. Type-approved tyres would therefore meet the free movement of goods requirements set out in Article 28 EC Treaty. If tyres are type-approved, they cannot be prevented from circulating within the EC, eg. as a result of a national ban on highly aromatic extracts in tyres. It would be very difficult to obtain exemption on health or environmental grounds in accordance with Art. 30 EC Treaty. It is therefore thought that future regulations will curtail a Swedish ban even further.

6.4.1 Notification of a Swedish ban in accordance with directive 98/34/EC

A Member State that intends to introduce technical regulations in for example the form of a ban or restrictions on the use of a product or chemical substance must notify the Commission of this fact. The notification sent to the Commission must contain details of the product and available alternatives together with a risk analysis carried out in accordance with the risk assessment guidelines set out in Council Regulation (EEC) No 793/93 on the evaluation and control of the risks of existing substances.

The Member State must as far as possible respect the views of the Commission and other Member States arising from the notification. Time frames are given for when proposed measures may be implemented based on whether or not the said parties express views on the proposal:

- If neither the Commission nor any Member State makes any detailed comments, the measures may be implemented at the earliest three months from the date the Commission receives the proposal.

- If the Commission or any Member State makes any detailed comments, the measures may be implemented six months from the date the Commission receives the proposal.

- If the Commission advises that it intends to propose or adopt a directive in that area, the Member State must wait 12 months before acting on the proposal.

- If the Council has adopted a joint position on a proposal for a directive, the Member State must wait 18 months before taking action.

6.5 Summary and conclusions

The account given above shows that a ban on highly aromatic extracts in tyres in Swedish legislation must be seriously curtailed to cover tyres not covered by Community type-approval regulations. The only way to introduce national regulations within an area regulated by the Community would be to take advantage of Articles 95.4 – 95.9 EC Treaty. As it is an area that is already harmonized through EC regulations, it would in accordance with Article 95.5 and amongst other things be necessary to prove that it is a problem specific to the Member State and a problem that arose after the adoption of the harmonization measure. It would be very difficult to claim that the first of these requirements is met, i.e. that the problem of highly aromatic extracts in tyres is specific to Sweden. According to Article 95.8, the Member State must notify the Commission, which is then responsible for investigating the matter immediately and deciding whether or not proposed measures are to be submitted to the Council.

In theory, it is possible to introduce a ban that only covers non-type-approved tyres. Before it is introduced, a regulation such as this must be communicated specifying grounds in accordance with the provisions of directive 98/34/EC. Article 8.1 of the directive states that any such notification must be accompanied by documentation in the form of available data and information about the effects on health, consumer protection and the environment and a risk assessment carried out in accordance with the principles set out in regulation (EEC) No 793/93 if it concerns what is known as an existing substance.

When it comes to Swedish law, both vehicle legislation and the Environmental Code authorize the issuing of a ban. The government has the authority to issue bans against the handling, import and export of chemical products. A draft proposal to the Swedish government is

therefore submitted in the form of a government Ordinance (see chapter 8).

There are a number of possible options for rules at Community level. Regulations on tyre type-approval are one such option. However, these rules do not currently contain any requirements relating to the effects of tyres on health or the environment except in regard to noise. Rules that restrict the use of chemical products in goods can be found in what is known as the restrictions directive. Special requirements that restrict the use of dangerous substances in cars can be found in the directive on end-of-life vehicles. The use of lead, mercury, cadmium and hexavalent chromium is currently regulated in the directive.

7. Impact analysis

7.1 Scope of the impact analysis

According to the commission from the Government, the National Chemicals Inspectorate is to investigate the prospects of a Swedish ban on the use of HA oils in automotive tyres. Part of the commission consists in carrying out an impact analysis which is to comprise:

- Calculation of the costs of proposed measures
- Analysis of the socio-economic effects and the effects on public finances of the proposals
- Analysis of the impact on other objectives established by the Swedish Parliament
- Special consideration of the effects on small and medium-sized enterprises

The National Chemicals Inspectorate has, however, interpreted the government commission more broadly and chosen to investigate the consequences of phasing out the use of HA oils in automotive tyres through various action alternatives. The following parameters have been used in the work on analysing consequences, both positive and negative, in various action alternatives: effectiveness, economics and competitive conditions as well as the impact on targets established by the Swedish Parliament.

Consequences in three scenarios are analysed in the chapter, each of these scenarios being based on a particular action alternative. The first scenario, the zero scenario, is based on the activities which in the present situation are in progress nationally and internationally and which may affect the use of HA oils in automotive tyres in the future. The second scenario takes as its starting point a national ban on HA oils in automotive tyres, and the third scenario describes the consequences of a harmonising regulation of HA oils in automotive tyres at Community level. The consequences described in scenarios 1 and 2 are the result of a comparative analysis in relation to the zero scenario.

7.1.1 Effectiveness

This parameter relates the effectiveness of various action alternatives, and subsequent scenarios, in attaining the overall goal of phasing out the use of HA oils in automotive tyres. The analysis covers underlying conditions, opportunities and obstacles, which may have an impact on effectiveness. Underlying conditions from the legal point of view, market incentives and the relative size of the market and the attitude of different

players towards the problem, as well as the conditions to be met to check compliance with any regulations are aspects on which the assessment of the effectiveness of the alternative actions is based.

7.1.2 Economics and competitive conditions

This parameter relates to consequences for the Swedish players in the supplier chain for automotive tyres, end-customers/consumers of automotive tyres and authorities in the form of impact on competitive terms and direct or indirect costs which may be the result of any measures initiated by the authorities to phase out the use of HA oils in automotive tyres. These consequences may be positive or negative in nature, and may therefore be essential to or obstacles to implementing an action.

Consequences for companies in the tyre industry, the costs to the state/authorities in connection with efforts to implement any actions and to check compliance with them, consequences for trade and for consumers/end-customers etc. are aspects underlying the assessment of the consequences of the action alternatives for economics and competitive conditions.

According to the Government commission, particular emphasis is to be put on consequences for small and medium-sized enterprises. In Sweden, companies with no more than 200 employees are defined as small and medium-sized enterprises. Companies with 0-9 employees are sometimes called micro-enterprises[57]. In the EU, companies with no more than 250 employees are defined as small and medium-sized enterprises[58]. There are currently around 900 companies in the tyre industry in Sweden. The individual enterprises are small, with between one and twelve employees. All consequences for the Swedish tyre companies covered by the analysis are therefore consequences for SMEs. Among the 25 members of the automotive industry organisation BIL Sweden, the four Swedish manufacturers and one of the general agents for imported vehicles have more than 200 employees. The other general agents have fewer than 200 employees.

7.1.3 Objectives established by the Swedish Parliament

How is attainment of the objectives established by the Swedish Parliament, particularly the environmental quality objectives, affected directly or indirectly by the action alternatives and the subsequent

[57] Statistics Sweden (SCB), Statistical Yearbook, 1998, Table 294
[58] European Commission Recommendation 96/280/EC

scenarios described in the impact analysis? The Swedish Parliament has adopted 15 environmental quality objectives. The work aimed at attaining these environmental objectives and therefore solving the major environmental problems within a generation is based on five fundamental values[59].

Three specific environmental quality objectives: *A Non-Toxic Environment, A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos* and *Flourishing Lakes and Streams* have been selected for analysis as this problem area is directly linked to attainment of these objectives. Any consequences for the Swedish Parliament's objectives for road traffic safety are also analysed in the various scenarios below. The dispersal of PAHs also has an adverse impact on the prospects of attaining the environmental quality objective *Clean Air,* but this is not covered by the analysis as the use of HA oils in automotive tyres is not considered to have a direct impact on the prospects of attaining these environmental quality objectives, apart from the fact that air quality may be affected by fires in old landfills with tyres. In energy recovery from used tyres, the incineration temperature is high and the flue gases are cleaned. Nor does the analysis cover the environmental quality objective *Good Built Environment*, as it has not been possible to quantify to what extent surface runoff from roads ends up in wastewater treatment plants.

In Government Bill 1997/98:145 "Swedish Environmental Objectives", the Government states that the waste hierarchy is a cornerstone of Swedish policy on waste. The waste hierarchy generally means that the disposal of waste is divided into the following priorities. First the quantity of waste should decrease, then waste should be dealt with by increasing re-use (the waste is used again without treatment), recycling of materials increases, nutrients or energy are recovered and finally any landfill residue should be as small as possible.[60]

Non-Toxic Environment – It is stated in Interim Target 3 that newly manufactured products as far as possible are to be free of:

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[59] Government Bill 2000/01:130

- promotion of human health
- preservation of biological diversity
- peservation of cultural heritage assets
- preservation of the long-term production capacity of ecosystems
- wise management of natural resources.

[60] The waste hierarchy is established in the EC's first waste strategy SEC(89) 0934 Final

- Substances that are carcinogenic, mutagenic or toxic to reproduction by 2007
- new, organic substances that are persistent and bioaccumulative, by 2005.
- Additional organic substances that are very persistent and very bioaccumulative (vPvB), by 2010
- other organic substances that are persistent and bioaccumulative (PB), by 2015

A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos – The environmental quality objective states that nutrient inputs and pollution are not to have an adverse effect on the conditions for biological diversity or the productive capacity of the marine environment in 2020.

Flourishing Lakes and Streams – Lakes and streams are to be ecologically sustainable and their varied habitats are to be preserved.There are viable populations of fish and other aquatic species that are directly dependent on lakes and streams. Nutrient inputs and pollution do not have an adverse effect on biological diversity.

The long-term objective for Swedish traffic safety states that "no one is to be killed or seriously injured as a result of traffic accidents". The long-term objective is put into practice by an interim target which states that "the number of persons killed as a result of road traffic accidents should have decreased by 50 per cent in 2007 in comparison with the 1996 level".

7.2 Zero scenario

The following scenario analyses, on the basis of the present-day situation, what consequences may follow if no measures other than those implemented, initiated or decided upon at present are implemented by the authorities to reduce the use of HA oils in automotive tyres. The analysis of the zero scenario is intended to provide a reference framework for assessing the need to take measures against the use of HA oils in automotive tyres.

7.2.1 Effectiveness

In the present situation, the use of HA oils in the tread of truck tyres and winter tyres for cars is being progressively phased out. According to information from the tyre industry, at present 75%[61] of all winter tyres on

[61] See Chapter 3.4

the Swedish market are free of HA oils in the tread. The fact that HA oils are being phased out in these types of automotive tyres but not in summer tyres can be explained primarily by the need for softening HA oils being smaller in the treads of these types of tyres than for summer tyres for cars, as well as the admixture of natural rubber. The presence of natural rubber means that the rubber blend is more compatible with alternative oils. In comparison with summer tyres, relatively lower requirements are also specified for wet grip for winter tyres in type approval, which has also contributed to the opportunities for replacing HA oils with low-aromatic oils. A level of demand for truck tyres containing no HA oils in the tread is also considered to be a significant contributory cause to phase-out. HA oils have not, however, been phased out to the same extent in the tyre carcass. The voluntary phase-out of HA oils in the tread or carcass has not taken place to remotely the same extent for summer tyres for cars. Reasons for non-substitution include, in particular, poorer wet grip, which is emphasised by various players in the product chain for tyres.

The activities which are in progress at present, or which may be anticipated in the near future, in the form of the development of market-driven policy instruments, such as positive ecolabelling of automotive tyres, signing of framework contracts and the development of the EKU tool in support of ecologically sustainable public procurement in government agencies and local authorities, should contribute to increased demand for environmentally sound automotive tyres. It ought to be possible for these activities to have a positive impact on the phasing-out of HA oils in automotive tyres.

Government agencies from 1 July 2003 will be able to use a new framework contract in the procurement of tyres.[62] The new framework contract can make it possible for the purchasing authorities to choose tyres with treads which are free of HA oils through mandatory requirements for suppliers' ranges of car tyres and tyres for trucks and buses to include tyres with treads free of oils classified as carcinogenic or environmentally hazardous under the EU classification and labelling directive 67/548/EEC. This requirement covers HA oils.

Public organisations[63] which cannot automatically utilise the co-ordination of government procurement can make use of the EKU tool in

[62] Regulation (1998:796) on Co-ordination of Government Procurement covers authorities under the government, i.e. the civil authorities, the armed forces and public enterprises.

[63] Examples which can be mentioned are the general insurance schemes, the Swedish Parliament and its authorities, some foundations and some state-owned

their procurement of automotive tyres to set relevant environmental requirements. Mandatory requirements are also set in the EKU tool for the tread of automotive tyres to be free of HA oils. The procurement of automotive tyres by the public sector, government authorities and local authorities adds up to large sums every year. However, this sum only represents a few per cent of the value of tyre sales on the whole Swedish market.

In the late 1990s, criteria were developed for positive ecolabelling of car tyres under the Nordic "Swan" ecolabelling scheme. The criteria for car tyres include requirements for the tread of automotive tyres to be free of HA oils. The positive ecolabelling of automotive tyres is an instrument, which makes it easier for consumers and other customers to demand environmentally sound automotive tyres.

The significance of Swedish consumers and other customers stipulating requirements for automotive tyres free of HA oils must be set against the relative size of the Swedish market for automotive tyres. The Swedish market at present accounts for less than one per cent[64] of the global market. In the case of truck tyres and winter tyres for cars, where the phasing-out of HA oils in the tread had already progressed relatively far, requirements in public procurement and other customer requirements for positive ecolabelling may be a significant factor in continued substitution. The Swedish market for winter tyres is large, in relation to other European countries, which provides a good foundation for acceptance of specified requirements among tyre manufacturers. The phasing-out of HA oils in automotive tyres, is still in its infancy for summer tyres for cars. Only a few summer tyres on the market fulfil the requirements in the EKU tool and in positive ecolabelling. In view of the fact that the Swedish market for summer tyres is relatively small and the level of interest among consumers in buying tyres containing no HA oils to date has been low, market-driven instruments can only be expected to have a small impact on the supply of environmentally sound summer tyres on the market. The significance of these instruments can therefore be assumed to be more modest for the development of summer tyres with treads free of HA oils than for winter tyres and truck tyres.

At a meeting between the National Chemicals Inspectorate and the European Association of the Rubber Industry (BLIC), it emerged that the outcome of the rubber industry's work on alternative oils in automotive

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companies. Although these organisations are to be regarded as procuring units under the Public Procurement Act (LOU), this does not mean that they are automatically included in the co-ordination of government procurement.

[64]Source: Bil Sweden, 2002

tyres depends on whether an EU-wide ban on HA oils in tyres comes about. Interest in the European industry in developing tyres containing no HA oils is therefore dependent on the competitive situation on the EU market. If rules that are neutral from the point of view of competition are not introduced for tyres imported into the EU in relation to tyres manufactured within the EU, BLIC considers that there is no incentive to develop tyres free of HA oils.

The national and EU-wide ban on the disposal of automotive tyres in landfills increases the pressure to find alternative options for the disposal of used tyres. It ought to be possible to create incentives for manufacturers of automotive tyres to substitute substances hazardous to health and the environment, chiefly PAHs, which in the present situation can create problems in material recycling.[65] Such development is opposed by an increasing trend towards energy recovery by incinerating end-of-life automotive tyres.

In the technique which dominates at present for producing base oil, e.g. for further preparation of lubricant oils, the distillate is purified of contents of aromatics. The HA oil used in automotive tyres is a residual product arising in the purification process. It has come to the knowledge of the National Chemicals Inspectorate in contacts with representatives of the industry that the present-day technique for preparing base oils is likely to disappear within 30 years in favour of a new technique in which no residual product arises. The supply of HA oils will gradually decline as the technique for producing base oils changes.

To summarise, the prospects of an effective phasing-out of HA oils in automotive tyres in the zero scenario are not great. This applies in particular to the use of HA oils in summer tyres, which is particularly worrying as summer tyres make up two-thirds of the approximately 5.5 million car tyres coming onto the Swedish market every year and additionally contain a higher concentration of HA oils than winter tyres and truck tyres. In the longer term, the rubber and tyre industries are compelled to find substitute oils for tyre manufacturing as the supply of HA oils decreases. The timeframe for a phase-out of HA oils in tyres governed by supply is, however, far too long.

7.2.2 Economics and competitive conditions

No market intervention in the form a ban is implemented in the zero scenario to phase out the use of HA oils in automotive tyres, and an

[65] See Chapter 3.5

analysis of the economics and competitive conditions resulting from the alternative action is therefore not relevant.

7.2.3 Targets established by the Swedish Parliament

A large proportion of the newly produced automotive tyres coming onto the Swedish market at present contain softening HA oils which are classified as carcinogenic under the EC classification and labelling directive 67/548/EEC. The majority of the PAHs contained in HA oils are also persistent and bioaccumulative. In the zero scenario, the use of HA oils in newly produced automotive tyres continues, and interim target 3 towards a Non-Toxic Environment is therefore not met within set time limits.

PAHs, which at present are dispersed among other ways through the use (and landfilling) of automotive tyres, have been the subject of attention in the water framework directive (2000/60/EC) as substances which through their hazardous properties can pose a risk to the aquatic environment. A study[66] has been carried out on the presence of organic substances and metals in sediment particles on the bed of the Stockholm archipelago and their effects on fish stocks. The study reveals the presence of PAHs in sediment particles and also elevated concentrations in fish with consequent adverse effects on the fish. The continued use of HA oils in newly produced automotive tyres in the zero scenario also means that the dispersal of PAHs from wear of automotive tyres, particularly from summer tyres, is still taking place, which signifies continued pollution of lakes and streams and of marine ecosystems.

Every year more than 60,000 tonnes of automotive tyres are scrapped in Sweden. These tyres could represent a resource. The presence of HA oils in automotive tyres may be an obstacle to good management of natural resources as various forms of material recycling are made more difficult by the hazardous substances contained in the HA oil. However, the demand for recycled tyre material is also low for other reasons such as the lack of financial incentives and uncertainty over the strength of the material when used, for example, as a filler in road-building. The use of HA oils in automotive tyres continues to a great extent in the zero scenario. The risk of exposing man and the environment to substances hazardous to health and environment remains when the material of automotive tyres is recycled. The opportunities for increasing resource efficiency in dealing with automotive tyres by increased recycling of material are therefore limited.

[66] The Institute of Applied Environmental Research at Stockholm University carried out this study on behalf of the City of Stockholm Environment and Health Administration together with Stockholm Vatten AB. See Chapter 2.4.

Tyre and vehicle manufacturers primarily make sure that tyres fulfil the technical requirements significant to the vehicle's performance. Technical performance and safety are not regarded as negotiable parameters. The authorities do not take any action to phase out the use of HA oils in automotive tyres in the zero scenario. It is therefore assumed that any measures taken by the tyre industry with the aim of replacing HA oils in tyres will take effect at a rate which is unlikely to jeopardise the present-day level of road traffic safety.

7.3 Scenario 1 – National ban on HA oils in automotive tyres

In the following scenario, the consequences, which can follow from Sweden introducing a national ban on HA oils in automotive tyres are analysed. The basis on which a national action alternative has been analysed is that the Swedish Government primarily commissioned the National Chemicals Inspectorate to investigate the prospects of a Swedish ban on the use of HA oils in automotive tyres.

7.3.1 Effectiveness

A national ban on HA oils in automotive tyres according to the legal analysis can only come into question for those automotive tyres, which are not covered by the EU-wide rules on type approval. Tyres for cars registered prior to 1 January 1998 and tyres for vehicles other than passenger cars do not require type approval under current regulations. Truck tyres and certain replacement tyres, newly manufactured and retreaded, could be covered by a Swedish ban in the present situation. The tyre industry, estimates, however, that the proportion of tyres, which could be covered by a national ban only represents a few per cent of the total number of automotive tyres coming onto the Swedish market every year. The tyres which could be covered by a Swedish ban on the use of HA oils in automotive tyres are newly produced replacement tyres imported into Sweden from third countries, principally from the United States and countries in Asia, which do not fulfil the requirements for type approval. Some retreaded automotive tyres on the Swedish market could also be affected by a national ban on HA oils in automotive tyres. There are a few Swedish retreaders who at present are not certified to have their tyres labelled as type-approved.

Requirements for type-approved tyres will, however, also apply to trucks and buses from 1 January 2005. Retreaded tyres manufactured from 1 January 2005 on must also have type approval. The proportion of automotive tyres on the Swedish market which would be covered by a

Swedish ban on the use of HA oils in automotive tyres would therefore be reduced further within the near future.

To summarise, the direct effectiveness of a Swedish ban on the use of HA oils in automotive tyres is extremely limited regardless of the time when any ban is introduced. The principal reason for proposing a Swedish ban, however, is that it may prove indirectly effective in phasing out the use of HA oils in automotive tyres, as Sweden can put the issue on the Community agenda by notifying a national ban. If notification of a Swedish ban, leads to action within the EU, the consequences will instead be as described in 7.4.

7.3.2 Economics and competitive conditions

A national ban must be notified to the European Commission under Directive 98/34/EC. A risk analysis also has to be attached to the notification under Regulation (EEC) No 793/93/EC if the ban relates to a chemical substance or group of substances. The work of drawing up a risk analysis of this type necessitates the input of great resources on the part of the authorities. In notifying a Swedish ban on the use of HA oils in automotive tyres, the authorities should, however, be able to justify a regulation by referring to other applicable rules for substances contained in HA oils due to their documented properties hazardous to health and the environment. If the European Commission or other Member States question a Swedish ban, however, great efforts may be required on the part of the authorities to draw up a complete risk analysis.

The Swedish ban on the use of HA oils in practice would exclude imported automotive tyres which are not type-approved from the Swedish market. As a consequence of a national ban on HA oils in automotive tyres, foreign manufacturers of automotive tyres which do not have type approval would be compelled to incur product development costs to meet the Swedish requirements. This might mean a changed competitive situation on the Swedish market. The development and conversion work which will be required on the part of the tyre industry to be able to fulfil the requirements in a Swedish ban on HA oils is probably not justified by the interest of the manufacturers of these tyres in the Swedish market. The consequence will probably be that present-day imported low-price tyres would disappear from the Swedish market, which would reduce the competition in the market with a consequent risk of increased customer/consumer prices for automotive tyres.

Swedish suppliers who at present import new replacement tyres, which are not type-approved are at risk of losing their present suppliers of automotive tyres in the event of a Swedish ban. The automotive tyres

currently imported from third countries are mostly low-price tyres, which principally compete with the retreaded tyres on the Swedish market. A Swedish ban, which in practice excludes the imported replacement tyres from the Swedish market might therefore contribute to increased demand for retreaded tyres.

The checking of compliance with a Swedish ban would need to be targeted at importers of new automotive tyres and Swedish manufacturers of retreaded tyres. No Swedish manufacturing of new automotive tyres occurs in Sweden. The prospects of checking compliance with a national ban on HA oils in automotive tyres imported into or manufactured in Sweden are likely to be good as a test method already in existence, IP 391, can be used in inspection. The cost of analysing the PCA concentration of automotive tyres through test method IP 391 amounts to between SEK 2,500 and 4,000[67].

7.3.3 Targets established by the Swedish Parliament

A Swedish ban on HA oils in automotive tyres is only expected to entail a slight reduction in the use of HA oils in automotive tyres on the Swedish market if notification of a Swedish ban does not lead to action at EU level. A Swedish ban on HA oils in automotive tyres would therefore not have any significant positive impact either on the prospects of fulfilling the environmental objectives of 'A Non-Toxic Environment', 'A Balanced Marine Environment, Flourishing Coastal Areas and Archipelagos' and 'Flourishing Lakes and Streams' or on otherwise safeguarding good management of natural resources through increased material recycling. In selecting a date for the entry into effect of any Swedish ban on HA oils in automotive tyres, account would have to be taken, however, of the need for development and conversion time for the players in the product chain for automotive tyres. The regulation would otherwise jeopardise road traffic safety[68]. It should then be possible to counteract a conflict of aims between reducing risks to health and the environment from the use of hazardous substances and good road traffic safety.

7.4 Scenario 2 – EU-wide ban on HA oils in automotive tyres

The consequences which can follow from an EU-wide ban on the use of HA oils in automotive tyres are analysed in Scenario 2. As a result of the

[67] Swedish Testing and Research Institute, 2003

[68] The risk of a lack of wet grip in summer tyres containing no HA oil in the tread, resulting in a relatively long braking distance, is a principal reason at present why HA oils have not been substituted. See Chapter 3.1.

interest in an EU-wide ban on HA oils in automotive tyres shown by BLIC and the German Environmental Protection Agency (UBA) during the work on the commission, the National Chemicals Inspectorate considers that there is justification for analysing this alternative action as well.

7.4.1 Effectiveness

Aspects in favour of an EU-wide ban on the use of HA oils in automotive tyres are the result of the legal analysis, the size of the EU market, the prospects of meeting the request by the tyre industry for rules that are neutral from the point of view of competition and interest from at least one other Member State in urging an EU-wide ban.

Most automotive tyres used in the EU are type-approved, and their free movement within the EU therefore cannot be affected by national bans. It would only be possible for type-approved automotive tyres also to be covered through an EU-wide ban on the use of HA oils in automotive tyres. The total use of automotive tyres by the fifteen member states together constitutes a significant market, approximately 36%[69] of the global market, which means a large customer base, even from the point of view of global tyre manufacturers. A ban within the EU on the use of HA oils in automotive tyres would therefore represent an effective risk-limiting measure for both the external environment and the working environment.

The attitude towards measures to substitute HA oils in automotive tyres is favourable among those players in the product chain for automotive tyres with which the National Chemicals Inspectorate has been in contact. There is a high level of acceptance for the assessment that HA oils lead to a risk of harm to human health and the environment. There is also support for risk-limiting measures at EU level among the majority of these players. The European Association of the Rubber Industry (BLIC) has indicated that it regards an EU-wide ban on the use of HA oils in automotive tyres as being essential to motivate continued work on substituting the HA oils. An EU-wide ban means that rules neutral from the point of view of competition are drawn up for tyres manufactured in the EU in relation to tyres imported into the EU, which according to BLIC provides incentives for the development of tyres free of HA oils.

The German Federal Environmental Protection Agency (UBA) has drawn up a proposal for an EU-wide ban on HA oils in automotive tyres. The UBA has met the Commission and BLIC for initial discussions on the

[69] Source: ACEA, 2001

scope and timing of the introduction of an EU-wide ban on HA oils in automotive tyres. The possibility of regulating HA oils in automotive tyres is therefore on the Community agenda. Collaboration between Sweden and Germany for an EU-wide ban on the use of HA oils in automotive tyres, however, provides better prospects of bringing about a ban through a change in Community law.

The aspects touched on above suggest that the prospects of Sweden working towards an EU-wide ban on the use of HA oils in automotive tyres are good.

To summarise, all the aspects indicated above contribute to an EU-wide ban on the of HA oils in automotive tyres being effective in bringing about an extensive phasing-out of HA oils in automotive tyres in Sweden and other Member States and indirectly in the global tyre market.

7.4.2 Economics and competitive conditions

Global production capacity for base oils today amounts to 33 million tonnes annually. HA oil is extracted at the refineries when base oil is purified. HA oils are largely used today for the manufacturing of automotive tyres. The annual need for the European tyre market of HA oils is 250,000 tonnes, which is used for the manufacturing of 2.1 tonnes of automotive tyres. If the use of HA oil were to be replaced by alternative oils, the HA oil could undergo further processing to petrol or naphthas, which means that the oil companies do not face the risk of obtaining a residual product in the purification of base oils which has no market outlet. If a substitution is made to alternative softening oils in automotive tyres, the supply of these alternative oils must also be safeguarded. There is surplus capacity in Europe at present in the production of base oils. The European producers can use the same process equipment for the preparation of low-aromatic oils as for the preparation of HA oils. The production of low-aromatic oils can therefore be scaled up in the event of increased demand from the tyre industry. This means that relatively low costs arise for the oil producers in the event of a substitution to the production of low-aromatic oils

The costs associated with a substitution to a low-aromatic oil are the costs of developing the rubber polymer, conversion of processes in tyre manufacturing and automotive industry tests, both in the laboratory and in the field, for the original fitting of tyres. At least one test period of two to three years is required. As further steps are required in the refining process to produce a low-aromatic oil, the oil also becomes a few SEK more expensive. One of the low-aromatic oils (MES) which could replace the HA oils is currently put to other uses, e.g. in the production of petrol.

An estimated value for this alternative use is 400 US dollars/tonne oil. The present cost of HA oil is around 150 US dollars/tonne oil. This means an increased cost of 250 US dollars/tonne oil. Around 250,000 tonnes of oil is used in the European/EU market in manufacturing rubber for the tyre industry. The increase in cost for European manufacturers is estimated at just over SEK 600 million (60 million US dollars). Converted into cost per tyre, the price is estimated to be SEK 1.50 – 4 higher due solely to the higher price of oil. The increase in the cost of the tyre when it reaches the final customer is estimated at 1 euro, i.e. around SEK 10.

Lower rolling resistance in automotive tyres is emphasised by the oil industry as a positive side-effect of the substitution of HA oils with certain alternative oils.[70] A consequence of this is that fuel consumption and therefore the cost of fuel for final customers/consumers is expected to fall. Reduced fuel consumption also contributes to reduced emissions for example of PAHs and carbon dioxide from vehicles.

Replacing oil may, however, mean that the rubber blends and therefore the tyre may acquire changed properties. This means that material development work must be carried out in the rubber industry before low-aromatic oils can be put to use. In view of the fact that important properties such as the road grip of the tyre must not be adversely affected, which might jeopardise road traffic safety, a sufficient lead is required allowing scope for the necessary development work before a EU-wide ban is introduced.

The increase in cost per tyre may have consequences for dealers in the form of increased capital expenses for stocking automotive tyres. Small and medium-sided dealers in particular might be adversely affected.

A large proportion of end-of-life automotive tyres today go for energy recovery (approximately 45%). A ban on HA oils in tyres may possibly contribute to increased demand for used automotive tyres for other use in the form of material recycling, e.g. for use as insulation of road surfaces. Adverse consequences can arise in the form of increased prices for end-of-life automotive tyres for present-day large users of end-of-life tyres, such as combined heat and power plans and the cement industry, if a ban on HA oils leads to more areas of use and therefore increased demand for end-of-life automotive tyres. The extent of these adverse consequences should not be so great in the short term, however, as there are large

[70] See Chapter 4

landfills within the EU with old end-of-life automotive tyres for which the alternative areas of use are few in number.

7.4.3 Targets established by the Swedish Parliament

In the scenario which an EU-wide ban on HA oils in automotive tyres might entail, almost all automotive tyres released onto the Swedish market are affected. The use of HA oils in the tyres released onto the Swedish market would be substantially reduced, or phased out completely. An EU-wide ban could therefore contribute to Interim Target 3 towards A Non-Toxic Environment being fulfilled. In the event of a substitution to oils which are not classified as carcinogenic, emissions of PAHs from the wear of automotive tyres would be reduced by 98%[71], and this signifies a reduced impact of PAHs on marine ecosystems as well as on lakes and streams. An EU-wide ban on HA oils in automotive tyres, in both the tread and carcass, could constitute a significant step towards creating a large resource in the form of end-of-life automotive tyres which could undergo material recycling without conflicts arising between the environmental quality objectives. Phasing out HA oils would increase the possibility of different forms of re-use/recycling of automotive tyres in several large areas of use through reduced risks of exposure of humans and the environment to substances hazardous to health and the environment.

The performance of automotive tyres is of great significance to the driving safety of the individual and to general road traffic safety. When choosing the time when an EU-wide ban comes into effect, account must be taken of the time required to answer all the process-engineering problems which at present remain before a summer tyre manufactured without HA oil has the same performance as a summer tyre containing HA oil in the tread. It ought to be possible in this way to avoid conflicts between the Swedish Parliament's road safety targets and environmental quality objectives concerned.

[71] See Chapter 4.2

8. Considerations and proposals

8.1 Introduction

Considerable progress has been made since the publication of the National Chemicals Inspectorate report "Nya hjulspår" (New Wheel Tracks) (6/94). This report has contributed towards activities having been started both in Sweden and elsewhere in Europe. In 1997, Continental Gislaved Däck AB presented the first newly manufactured winter tyre containing no HA oils in the tread. Today, around 75% of newly manufactured winter tyres are free of HA oils in the tread. Swedish retreaders were also quick to replace the HA oil in the tread. Truck tyres are also free of HA oils in the tread, and thanks to the emphasis on aspects of performance other than wet grip, the tyre carcasses can also be made without or with a substantially lower concentration of HA oil than tyres intended for cars. On the other hand, the situation is largely unchanged with regard to newly manufactured summer tyres for light vehicles. They still contain HA oils in the tread owing to problems with wet grip which are of decisive importance to braking distance and therefore road traffic safety. Tests show that there is a 2-4% difference in braking distance on a wet road surface between summer tyres made with HA oil and summer tyres made with alternative low-aromatic oils in the tread owing to poorer wet grip[72]. Calculating on the basis that summer tyres account for around 60% of the aftermarket and that just over 1 million originally fitted tyres reach the market via new-vehicle sales, this results in an annual addition to the Swedish market of nearly 4 million tyres containing HA oil in both the tread and tyre carcass.

The activities, which are in progress in the form of public procurement, positive ecolabelling such as the Swan labelling scheme etc. have some bearing on the commercial use of tyres. Private tyre customers, on the other hand, are generally unaware that automotive tyres contain HA oils and therefore do not exert major pressure for tyres free of HA oils to be developed.

Sweden has not had any domestic manufacturing of new automotive tyres since Continental Däck AB closed down its plant in Gislaved in July 2002. The Swedish automotive industry and tyre industry are therefore totally dependent on obtaining a supply of tyres from manufacturers outside Sweden, particularly from other European countries. With the small market which Sweden represents, less than one per cent of the

[72] Personal communication, Sten Persson, Volvo Car Corporation, 2003

global market for the sale of new passenger cars[73] and less than two per cent of the EU market for new passenger cars[74], Swedish players have limited opportunities to stipulate requirements for the HA-oil content of tyres. The tyre industry estimates that the same market ratio applies to replacement tyres for cars.

The Swedish Government has stated that there are strong reasons for a rapid ban on the use of HA oils in automotive tyres as it has not been possible for the phase-out of HA oils to be fully implemented on a voluntary basis.

With the support of data and conclusions from previous chapters, an overall assessment is made of how the issue of a ban on putting automotive tyres containing HA oils on the market can be put on the European Community agenda. There are two possible courses of action. One is by notifying a national ban. The other is to put the issue directly to the European Commission, which can be done in co-operation with Germany.

8.2 National ban

A conclusion from the legal analysis is that under the directive on type-approved vehicles and tyres, a type approva,l which has been granted in one Member State is valid throughout the Community. No Member State may therefore ban or restrict the putting of type-approved vehicles or type-approved tyres with added HA oils on the market. Exceptions only apply in the case of immediate danger to traffic.

The requirement of type approval applies to passenger cars registered after 1 January 1998. It is up to the individual Member State to stipulate requirements that replacement tyres for such cars also have to have type approval. The National Road Administration has issued such requirements in Sweden.

The fact that the requirement of type approval only covers some cars provides an opening for introducing a national ban on HA oils in truck tyres, tyres for cars registered before 1 January 1998 and retreaded tyres where there are no requirements for type approval. According to information from the Swedish tyre industry, however, both car tyres and truck tyres made by large tyre manufacturers are type-approved, partly because several Member States require this. The same applies to

[73] Source: BIL Sweden (2002).
[74] Source: ACEA, The European Automakers (2001).

retreaded tyres. On the other hand, in the judgement of the industry there are a small number of low-price tyres imported from third countries, which are not type-approved and a few smaller retreaders who are not yet certified to be allowed to label their tyres as type-approved. It must be added, however, that Swedish-made retreaded tyres are already free of HA oils in the tread. Altogether there are a few hundred such tyres supplied to the Swedish market every year. A national ban would therefore only affect a few per cent of the total supply of tyres per year.

Further restriction of this proportion is to be expected when the international ECE regulations[75] adopted by the EU come into effect through national legislation in 2005. The requirement for type approval will also apply to tyres for truck and buses and to retreaded tyres.

Conclusions

To summarise, it can be said that a unilateral ban would have a very small scope and would not be in effect for long, or not have time to come into effect, before the more extensive international requirement for virtually all tyres released onto the market to be type-approved after 2005. A national ban is therefore not effective in itself, apart from being a way of putting the issue on the Community agenda. It is, however, a clear message that an additive, which has serious adverse properties for human health and the environment and is dispersed directly to the environment via a product, which is used daily by a large number of people is not acceptable.

The formulation of a national ban with regard to the maximum permitted concentrations of carcinogenic PAHs and time of entry into effect should be in line with the intentions Germany has for a ban at Community level.

The effectiveness of a ban, regardless of whether it is at national level or at Community level, depends on whether it is possible to check on compliance. The prospects here are good, as there are test methods which can quantify the amount of polycyclic aromatic compounds both in the unused oil and in the oil contained in a finished tyre. It needs to be said, however, that if the tougher requirements for the maximum permitted concentrations of twelve PAHs in the process oil which Germany advocates gain acceptance within the EU, new and more sensitive test methods will need to be developed. In the test method used today to measure the PCA concentration[76] in the unused oil, the PCA concentration is measured in a DMSO extract. DMSO is a carcinogenic

[75] The regulations are described in 6.2

[76] PAH + aromatics substituted with nitrogen, sulphur or oxygen compounds

substance. The test method therefore entails risks to the personnel who have to perform the measurements. Not least for this reason, it is essential to develop another less risky test method.

8.3 Community-wide rules

As most tyres released onto the European market are, or within the near future will be, type-approved and therefore cannot be covered by a national ban, there is much to suggest that Sweden should also consider other ways of putting the issue on the Community agenda so that an equivalent ban can be introduced through a change in Community law. The time is right for such action for two reasons.

The first reason is that the European Association of the Rubber Industry (BLIC), which covers the major international tyre manufacturers with production in Europe, considers that HA oils in all new types of tyres may be replaced by 2008. BLIC has co-operated and will continue to co-operate with all links in the production chain so that a substitution to low-aromatic oils can be implemented within this period of time. It is clear to BLIC, however, that their incentive for developing the whole tyre segment without the addition of HA oils depends on common rules neutral from the point of view of competition in the form of statutory requirements for the whole European market. The National Chemicals Inspectorate was informed of this position at a meeting in December 2002, and this view has also been presented to the European Commission. According to BLIC, one of the reasons why they are now actively working on replacing highly aromatic oils are the conclusions presented in KemI report 6/94.

The second reason is that the German Federal Environmental Protection Agency, the Umweltbundesamt (UBA), is working intensively on strategies for a phasing-out of HA oils in automotive tyres and has presented a proposal for Community-wide regulation of HA oils in automotive tyres for the Commission. As part of this work the UBA has held discussions with BLIC with the aim of bringing forward the entry into force of a Community ban by a few years in comparison with the BLIC proposal and having a stricter definition of a low-aromatic oil by setting a concentration limit for the aggregate total of twelve identified PAHs contained in HA oils. In its communication with BLIC, the UBA makes reference to KemI report 6/94. The UBA requests support from Sweden in the work of bringing about EU-wide regulation of HA oils in automotive tyres.

Both the UBA and BLIC prefer a common year for entry into force for all types of tyres, with the exception of retreaded tyres, where it is proposed that entry into effect only relates to requirements for the tread, to guard against retreaders being eliminated as an industry. The retreaders are dependent on obtaining tyre carcasses free of HA oils before their whole tyres can be free of HA oils. As it takes about 4-5 years before a tyre is worn out and comes for retreading, there will be a delay before whole retreaded tyres can be free of HA oils.

In addition, the EU market with its approximately 36% of the global market for the sale of new cars[77] and sale of replacement tyres represents a large customer base and therefore also provides an incentive for producers outside Europe to follow the trend in the EU. In the experience of BLIC, tyre producers both in the United States and in Asia are receptive to requirements from the European market.

Conclusions

The prospects for gaining acceptance for Community-wide regulation of HA oils in automotive tyres should be good as two important European players are working in the same direction. It should be possible for such regulation to become reality within three to four years. Sweden, which has nearly ten years of experience of work on phasing out the use of HA oils, should be able to make important contributions with regard to how a proposal for regulation at Community level can be formulated by actively lobbying the Commission.

8.4 Discussion and proposals

As indicated by the conclusions above, a ban on HA oils in automotive tyres will only be effective if it can be implemented through Community law. The official and established channels for putting an issue on the Community agenda include, for example, via notification of proposals for a national ban or restrictions (provided there are no harmonised Community rules), through risk-management strategies in the programme for existing substances or on the basis of undertakings made in international conventions.

If there are harmonised Community rules in the area, a single Member State can raise the issue of amending these rules through direct contact with the Commission, which will then draw up proposals for amended rules. Such contact can be made, for example, pursuant to Article 95.8 of the Treaty of Rome.

[77] Source: ACEA, The European Automakers (2001).

A suitable strategy may therefore be to actively lobby the Commission so that a ban on HA oils can be implemented through amendment of Community law. The prospects of gaining a hearing and a breakthrough for an amendment of Community law can be boosted by co-operating with Germany, which has prepared a basis for an EU-wide ban on HA oils in all types of automotive tyres. As Germany has initiated discussions with the Commission regarding a ban on HA oils in automotive tyres, the issue has already been put on the Community agenda.

If the Swedish Government opts to submit a proposal for a national ban on HA oils in car tyres, this proposal should be harmonised with the proposal, which Germany has presented to the Commission. The submission of a proposal for a national ban on HA oils in car tyres entails a requirement to follow the procedure laid down in Directive 98/43/EC (on an information procedure regarding technical standards and specifications). A submission of this kind must include a risk analysis and an assessment of proportionality in relation to Articles 28 and 30 of the Treaty establishing the European Community, which is described in Chapter 6. How extensive a risk analysis needs to be depends on how the Commission handles the proposals, which Germany has submitted. In the best case, the need for such an analysis can be reduced if there is acceptance for the ban relating to the substances with properties proven to be harmful to health and the environment. Because of their hazardous properties, these substances have been identified in several international forums, but also for example in the context of exhaust fumes, as being essential to phase out.

As mentioned earlier, the effectiveness of a ban depends on whether it is possible to monitor compliance with it. The German proposal, in its present version, is only aimed at the oil as such and not at the oil in the actual tyre, but states that analytical methods for measuring the concentration of PAHs both in the unused oil and in the oil contained in the tyre must be included in the directive which puts the bans into effect. Sweden should already make it clear now that the ban must also be targeted at the oil in the tyre and refer to the modified IP 391[78] method which is used at present. The concentration limit for PCAs in the oil should be set at 10%. As IP 391 measures all PCAs in the oil, a higher value is obtained than when the PCA concentration is measured in the unused oil. At the concentration limit of 10% measured according to IP 391, PCAs in the unused oil are judged to be below 3%, which is the

[78] The test is worked up in accordance with standards ISO 1407:1992 and ISO 4645:1984. The extract is then analysed using IP 391, which is an HPLC method that measures the concentration in the oil which is contained in the tyre.

concentration limit for when the oil fulfils the criteria for carcinogenicity classification. If a more sensitive method is available when a ban comes into force, a reference can be made to this method instead.

The list of twelve PAHs whose total concentration must not exceed 10 ppm according to the German proposal may be regarded as an example list, which can be amended during further discussions. As the number of PAHs which may be present in an HA oil is high and many PAHs contained in a highly aromatic extract may, moreover, be unknown at present, as well as stating a total concentration limit for twelve of them, it should also be made a requirement that the oil does not fulfil the criteria for category 1 or 2 carcinogenicity classification. It can be ensured in this way that it is not only the identified PAHs that are restricted but also other PAHs, which contribute to the oil having carcinogenic properties. Benzo(a)pyrene is often used as an indicator of the presence of PAHs. The German proposal contains a requirement that the concentration of benzo(a)pyrene must not exceed 1 ppm.

A great deal of progress has been made in the work towards replacing HA oils. The issue has also already been put on the Community agenda. With regard to the time required for the practical work of implementing complete replacement of HA oils in both the tread and carcass of the tyre, the National Chemicals Inspectorate considers it reasonable to set the date of entry into effect at 1 January 2006, which is in line with the assessment made by Germany. Although insufficient quantities of the alternative oils are produced at present to be able to replace the HA oils, the European oil industry, according to information supplied by the Umweltbundesamt (UBA), is in favour of increasing production when the demand for such oil rises.

Summary
The German proposal as it stands at present should be developed so that it is clearly apparent that a ban is aimed both at the use of HA oils in the manufacturing of tyres and at tyres containing HA oils.

The oil must not be used in the manufacture of tyres if it fulfils the criteria of carcinogenicity, and contains more than 10 ppm in total of the twelve designated PAHs or more than 1 ppm of benzo(a)pyrene.

In order to be able to supervise compliance with the ban, reference should be made to the modified IP 391 method, pending the development of a more sensitive method. There should be a requirement for the concentration of PCA in the oil included in the tyre not to exceed 10 %

according to this method to ensure that the oil does not fulfil the classification criteria of carcinogenicity.

The National Chemicals Inspectorate considers it reasonable to set the time for entry into force at 1 January 2006 to allow for the practical work which is required to fully replace HA oils in both the tread and carcass, which is in line with the standpoint of Germany

The National Chemicals Inspectorate proposes as follows:

- **Sweden should actively urge an EU-wide ban on HA oils in automotive tyres by presenting a notification to the Commission in accordance with Article 95.8 of the Treaty establishing the European Community. Sweden should co-operate in this work with Germany for a ban to include both the use of HA oils when tyres are manufactured and tyres containing HA oils.**

- **A national ban on HA oils in automotive tyres can only include tyres that are not type-approved, which corresponds to a few per cent of the tyres placed on the market each year. If the Swedish government chooses to formulate and notify a national ban, it should have the wording below.**

Ordinance on the Prohibition of Highly aromatic Oils in Certain Tyres

Issued on xx

The Government prescribes as follows.

Section 1: For the purpose of this Ordinance, the following definitions shall apply:

4. *tyre,* pneumatic tyre, as original or spare tyre, which is intended for fitting to vehicles which are covered by Council Directive 70/156/EEC of 6 February 1970 on the approximation of the laws of the Member States relating to the type-approval of motor vehicles and their trailers,
5. *PAHs,* polycyclic aromatic hydrocarbons,
6. *PCAs,* PAHs and polyaromatics substituted with sulphur, nitrogen or oxygen compounds.

Section 2: In the manufacturing of tyres or treads for retreaded tyres, oils shall not be used which
- contain PAHs which are to be classified as carcinogenic in categories 1 or 2 under applicable regulations on the classification and labelling of chemical products;
- contain one or more of the PAHs stated in the annex in a total concentration amounting to 10 ppm or more, or,
- contain benzo(a)pyrene in a concentration amounting to 1 ppm or more.

Section 3: Tyres and treads for tyres intended for retreading shall not be released onto the market if they contain oils as referred to in Section 2. The tyre or tread shall not be regarded as containing such oils if the concentration of PCAs is less than 10% in measurement according to the method indicated by the annex.

Section 4: The provisions of Sections 2 and 3 shall not apply to tyres which have been type-approved in accordance with Council Directive 92/23/EEC of 31 March 1992 relating to tyres for motor vehicles and their trailers and to their fitting or are type-approved in accordance with ECE Regulations 30, 54, 64, 108 and 109.

Section 5: Further regulations relating to implementation of this Ordinance will be notified by the National Chemicals Inspectorate

Section 6: Chapter 29 of the Environmental Code contains provisions on penalties and forfeiture.

This Ordinance comes into force on 1 January 2006.

On behalf of the Government

Annex

PAHs referred to in Section 2

PAH	*CAS number*
Fluoranthene	206-44-0
Pyrene	129-00-0
Benzo(a)anthracene	56-55-3
Chrysene/Triphenylene	218-01-9
Benzo(b)fluoranthene	205-99-2
Benzo(j)fluoranthene	205-82-3
Benzo(k)fluoranthene	207-08-9
Benzo(e)pyrene	192-97-2
Benzo(a)pyrene	50-32-8
Dibenzo(a,h)anthracene	53-70-3
Indenol(1,2,3-c,d)pyrene	193-39-5
Benzo(g,h,i)perylene	191-24-2

Method for measurement of PCAs according to Section 3

The following standards shall be applied in the measurement of PCA in the oil:

SS 155116 Petroleumprodukter - Bestämning av aromater i dieselbrännolja - Mono- och dicykliska aromatiska föreningar samt PAH, vilken motsvarar IP 391/90 Aromatic hydrocarbon types in diesel fuels petroleum distillates by high performance liquid chromatography with refractive detection, equivalent to IP 391/90.

SS-ISO 1407 Edition 1. Gummi - Bestämning av halten extraherbara ämnen, vilken motsvarar ISO 1407:1992 Rubber – Determination of solvent extract, equivalent to ISO 1407:1992.

SS-ISO 4645 Edition 1. Gummi och gummiprodukter - Vägledning för identifiering av skyddsmedel - Tunnskiktskromatografiska metoder, vilken motsvarar ISO 4645:1984 Rubber and rubber products - Guide to the identification of antidegradants - Thin layer chromatographic methods, equivalent to ISO 4645:1984.

Glossary

Substance/product names and biological terms

Ames test	A method that can detect whether a chemical substance can give rise to changes in the genotype
Bioaccumulative	Tendency of chemical substances to accumulate in living organisms
Biomagnification	Enrichment of a chemical substance along the food chain.
Bioavailability	Ability of a chemical substance to be taken up by living tissues
Bitumen	An oil product used to hold the stone material together in asphalt
Carcinogenic	Chemical substances that can give rise to cancer
CMR	Carcinogenic, mutagenic or toxic to reproduction
DAE	Distillate aromatic extract/*HA oil is also known by this name*
DMSO Extraction method	Dimethyl sulphoxide is a polar solvent that dissolves polar polycyclic aromatic hydrocarbons
EROD activity	Exposure to dioxin-like compounds can be detected by the detoxification system being put into action. The effect is measured in the laboratory environment
Phototoxic	Toxicity of a chemical substance when the skin is exposed to it together with light
HA oil	Highly aromatic oil
Endocrine-disrupting	Ability of chemical substances to give rise to adverse effects on the endocrine system
MES	Mild Extractant Solvate/*A paraffin oil that is a possible alternative to HA oil*
Mutagenic	Ability of chemical substances to damage the genetic information of the cell (genotype)
PAH	Polycyclic aromatic hydrocarbons
PCA	PAH + aromatics substituted with nitrogen, sulphur or oxygen compounds
Persistent	Difficult to break down, long-lived
POP	Persistent organic pollutants
Reprotoxic	Ability of chemical substances to harm the reproductive system/offspring
Styrene-butadiene	A synthetic rubber polymer
TDAE	Treated Distillate Aromatic Extract/*A possible alternative to HA oil*

Vulcanisation process	Rubber polymers are converted from a plastic state to a more elastic state

Organisations

ACEA	Association des Constructeurs Européens d'Automobiles/The European Automakers/*the sector organisation of the European automotive industry*
BIL Sweden	Sector organisation for companies manufacturing and importing cars, trucks and buses.
BLIC	Bureau de Liaison des Industries du Caoutchouc de l'U.E./European Association of the Rubber Industry
DF	Federation of Tyre Suppliers
DRF	Swedish Tyre Specialists and Ret readers
SDAB	Swedish Tyre Recycling
SP	Swedish Testing and Research Institute
STRO	Scandinavian Tire and Rim Organisation/*Industry organisation for tyres*
RS	Retreading Section
UBA	Umweltbundesamt/German Federal Environmental Protection Agency

Other

BEEP	Biological Effects of Environment Pollution in Marine Coastal Ecosystems
Automotive tyres	Tyres for cars, trucks and buses
LRTAP	Convention for Long Range Transport of Airborne Pollutants
HELCOM	Baltic Marine Environment Protection Commission*/Helsinki Convention*
IP 346	Method that measures PCA concentration in the unused oil
IP 391	Method of determining PCA concentration in the oil contained in the finished tyre
OSPAR	Oslo and Paris Conventions for the Prevention of Marine Pollution
REACH system	Registration, Evaluation and Authorisation of Chemicals. *New system for monitoring of chemicals in the EU*

SME	Small and Medium-sized Enterprises/*small and medium-sized businesses with less than 200 employees*
TGD	Technical Guidance Document/*Technical Guidance Document within the programme for existing substances in the EU*

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Annex 1

External reference group

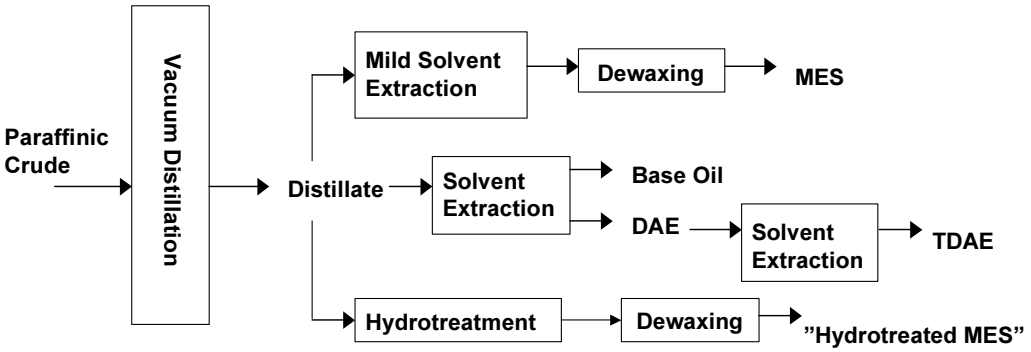
Authorities and agencies
Västra Götaland County Administration
Swedish Environmental Protection Agency
National Road Administration
VTI – Swedish National Road and Transport Research Institute

Trade and industry
BIL Sweden
Federation of Tyre Suppliers
Swedish Tyre Specialists and Retreaders
STRO - Scandinavian Tire and Rim Organisation
Association of Swedish Rubber Manufacturers
Nokian Däck AB
Nynäs Naphtenics AB
Trellleborg AB

Others
SIS Eco-labelling
Bokoxen AB

Annex 2.

Process diagram for manufacturing of the low-aromatic oils MES and TDAE



Source: Nynäs Napthenics AB, 2002.