KEMI
Kemikalieinspektionen
Swedish Chemicals Agency

Authorisations and Guidance

COMPARATIVE ASSESSMENT REPORT
Date
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Comparative assessment report:

Creosote; versus other wood preservatives, other materials or techniques.

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Version 1.1	**Correction** Updated page numbering Section 1.1.1: Updated names of product families and members. Added information on asset number. Section 1.9 Overall conclusion: Correction of risk ratios in the marine environment. Updated page numbering	July 2016

Evaluating Competent Authority: Sweden

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1 Comparative assessment

1.1 Background:

The Swedish Chemicals Agency (KemI) is currently evaluating four applications for authorisation of a biocidal product family (PT 8). The products contains creosote as the active substance.

Creosote has a harmonised classification in accordance with Regulation (EC) No 1272/2008[1] as carcinogen in category 1B and contains constituents that have been considered as persistent, bioaccumulative and toxic in accordance with the criteria set out in Annex XIII to Regulation (EC) No 1907/2006[2,3]. Creosote fulfils therefore the exclusion criteria according to Article 5.1(a) and (e) of the Biocidal Products Regulation (EU) No 528/2012 (BPR)[4] and should consequently in line with Article 10.1(a) of the BPR be regarded as a candidate for substitution. KemI has therefore, as outlined in Article 23(1) of BPR performed a comparative assessment for the products and produced this report.

Furthermore, this assessment aims also to consider the specific provision stated in the Commission Directive 2011/71/EU amending Directive 98/8/EC to include creosote as an active substance in Annex I of the Directive 98/8/EC (BPD)[5]:

- "Biocidal products containing creosote may only be authorised for uses where the authorising Member State, based on an analysis regarding the technical and economic feasibility of substitution which it shall request from the applicant, as well as on any other information available to it, concludes that no appropriate alternatives are available."

[1] Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006.
[2] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH).
[3] The Committee for Risk Assessment of the European Chemicals Agency has considered the constituent anthracene to be persistent, bioaccumulative and toxic (PBT) and fluoranthene, phenanthrene and pyrene to be very persistent and very bioaccumulative (vPvB).
[4] Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products.
[5] Directive 98/8/EC of the European Parliament and of the Council of 16 February 1998 concerning the placing of biocidal products on the market.

Please note, given the complexity of the matter, this comparative assessment does not cover all possible aspects in full detail. It is focused on the use areas specified in the application for product authorisation which are intended for the products in Sweden and potential alternative wood preservatives or non-chemical methods that are applicable to use in Sweden. The following use areas are addressed in this assessment:

- Railway sleepers
- Poles (electric power transmission and telecommunications)
- Fence posts for use in the agricultural sector
- Marine applications

In order to obtain information regarding the availability of possible alternatives as well as experience from end users, KemI posted a request for information on the website of the Agency in the end of 2013. The content of the request of information and the contributions that were received are presented in Appendix II.

1.1.1 Products falling within the scope of the assessment

Applicant: KOPPERS International BY
Type of application: Authorisation of a biocidal products family
Name: Creosote BPF Koppers
Asset Number in R4BP: SE-0013846-0000
Family Members: WEI B
WEI C

Applicant: BILBAINA DE ALQUITRANES, S.A.
Type of application: Authorisation of a biocidal products family
Name: Creosote (Maderoil Grade C and B) BPF
Asset Number in R4BP: SE-0013848-0000
Family Members: Creosote (Maderoil Grade B)
Creosote (Maderoil Grade C)

Applicant: RÜTGERS Basic Aromatics GmbH

Type of application: Authorisation of a biocidal products family

Name: Creosote EN 13991 Grade B/C/C GX-plus

Asset Number in R4BP: SE-0013847-0000

Family Members: Creosote EN 13991 Grade B
Creosote EN 13991 Grade C
Creosote EN 13991 Grade C GX-plus

Applicant: RÜTGERS Belgium NV

Type of application: Authorisation of a biocidal products family

Name: EN 13991 Creosote

Asset Number in R4BP: SE-0013849-0000

Family Members: EN 13991 Creosote Grade B
EN 13991 Creosote Grade C

1.2 Legislation and guidance

Comparative assessment in accordance with Article 23 of the BPR

Article 23 of the BPR lays down the conditions for a comparative assessment of biocidal products. According to Article 23(3) shall the receiving competent authority prohibit or restrict the making available on the market or the use of a biocidal product containing an active substance that is a candidate for substitution where a comparative assessment, demonstrates that both of the following criteria are met:

a) for the uses specified in the application, another authorised biocidal product or a non-chemical control or prevention method already exists which presents a significantly lower overall risk for human health, animal health and the environment, is sufficiently effective and presents no other significant economic or practical disadvantages;

b) the chemical diversity of the active substances is adequate to minimise the occurrence of resistance in the target harmful organism.

The comparative assessment shall be performed in accordance with the technical guidance notes referred to in Article 24. However, this assessment is based on the interim guidance document: "Note for Guidance - Comparative assessment of biocidal products", CA-March14-Doc.5.4, (hereinafter – the guidance document on comparative assessment), which was available at the time this assessment was started.

Specific provision according to the Commission directive 2011/71/EU

As recognised above, the inclusion directive for creosote includes a specific provision stating that products containing creosote may only be authorised for uses where the authorising Member State concludes that no appropriate alternatives are available. The conclusions shall be based on an analysis regarding the technical and economic feasibility of substitution which it shall request from the applicant, as well as on any other information available to it.

No guidance have been developed under the biocidal products directive 98/8/EC (BPD) in order to facilitate for applicants or authorising Member States how to comply with this provision. KemI considers however that a comparative assessment made in accordance with Article 23 of the BPR covers the aspects that shall be considered according to the specific provision. In accordance with the specific provision for creosote the Member state can only authorise a creosote containing product if their analysis show that there are no alternatives available. Hence, there is a difference to the provisions in Article 23 of the BPR, where in order to prohibit a product it must be demonstrated that both criteria in Article 23 of the BPR are fulfilled.

Please note that the proposal for decision regarding authorisation for creosote containing products will take into account both the comparative assessment based on Article 23 of the BPR and the specific provision for creosote. The conclusions of this assessment can, however, differ depending on whether they are based on Article 23, BPR or the specific provision.

1.3 Documentation

The following information have been considered in this comparative assessment.

- Documents submitted by the applicants.

  A comprehensive list of documents submitted by the applicants in context of the comparative assessment is given in Appendix I.

  - An analysis of the technical feasibility of substitution of creosote for the treatment of wood for poles, sleepers, fencing, agricultural uses (including tree stakes), fresh and sea water uses and professional use.

    This report is mainly based on information on and experience of wood uses in the UK.

  - A socio-economic analysis.

    This document presents the early findings of a socio-economic study of creosote as a preservative for wood poles for power and telecommunication networks. A complete socio-economic analysis will according to the applicant will be finalised before November 2016 by time for the application of renewal of creosote as an active substance.

  - Several lifecycle analyses.
- Information on authorised wood preservatives in Sweden, obtained from the Swedish Pesticide register[6].
- Information received during a public consultation initiated by the Swedish Chemicals Agency in November 2013 regarding the availability of possible alternatives to creosote as well as experience from end users. The content of the request of information and the contributions that were received are presented in Appendix II. Contributions have been received from:
  - Manufactures of poles and railway sleepers.
  - Manufactures of alternative wood preservatives.
  - Swedish energy and network companies.
  - The Swedish transport administration.
  - A railway network company.
  - Industry associations.
  - Concerned Member States.
- A summary of the outcome for the stakeholder consultation on creosote which was performed 2008 initiated by the EU Commission, see Appendix III.

[6] http://webapps.kemi.se/BkmRegistret/Kemi.Spider.Web.External

1.4 Intended uses of the biocidal product

Uses intended in Sweden

The applicants have applied for the following uses of the creosote products in Sweden: Preventive protection of; wooden railway sleepers (use class[7] (UC) 3), wooden poles for electricity and telephone lines (UC4), wooden fence posts for use in the agricultural sector (UC4) and wood for marine installations (UC5). More details are presented below.

Uses

Use #1 Sweden - Railway sleepers	
Product Type	PT8 Wood preservatives
Aim of treatment	Preventive protection
Use class wood	UC 3
Target organism (including, where relevant) development stage)	Wood rotting basidiomycetes Soft rot micro-fungi
Field of use	Railway sleepers
Application method	Pressure impregnation
Application rate	70 - 80 kg/m³
Category of users	Industrial (trained professional)

Use #2 Sweden - Poles for electricity and telephone lines **Use #3 Sweden - Agricultural fencing**	
Product Type	PT8 Wood preservatives
Aim of treatment	Preventive protection
Use class wood	UC4
Target organism (including, where relevant) development stage)	Wood rotting basidiomycetes Soft rot micro-fungi
Field of use	Poles for electricity and telephone lines Agricultural fencing
Application method(s)	Pressure impregnation
Application rate	100 – 110 kg/m³
Category of users	Industrial (trained professional)

[7] Use class (UC) according to Standard EN 335:2013

Use #4 Sweden - Marine installations	
Product Type	PT8 Wood preservatives
Aim of treatment	Preventive protection
Use class wood	UC5
Target organism	Marine crustaceae and molluscs (marine borers)
Field of use	Marine installations
Application method(s)	Pressure impregnation
Application rate	360 - 400kg/m^3 penetration class NP5 (EN 351)
Categories of users	Industrial (trained professionals)

Currently, there are three wood preservatives containing creosote authorised in Sweden under national rules in accordance with the transitional measures in Article 89 of the BPR. These products are intended for the following uses.

- Against rot in wood to be used in professional activities to railway sleepers or round timber for transmission lines or marine installations.
- For pressure impregnation.

1.5 Screening phase of the comparative assessment

In accordance with the guidance document, during the screening phase it shall be checked whether the diversity of the active substance, product type and mode of action combination in authorised biocidal products (BP) is adequate to minimise the occurrence of resistance in the target organisms. Article 23(3)(b) refers to the adequate chemical diversity of the available active substances within a given product type/use/target organism combination as one of the two *sine qua non* conditions to be met in order to allow a restriction or prohibition of a BP subject to comparative assessment. The screening phase shall allow through a simple assessment to judge whether it is required or not to perform a comprehensive comparative assessment.

According to the guidance document on comparative assessment adequate chemical diversity means that at least three different active substances - mode of action combinations should remain available through authorised BPs. The reference member state, shall according the guidance document on comparative assessment, discuss the suitability of identified BPs authorised under BPD or BPR under its own market as well as under other member states markets. However, detailed information regarding products authorised in other Member States is not yet searchable in R4BP3. Thus, only products authorised in Sweden are included in this assessment.

In Sweden 30 wood preservatives have been authorised under the Directive 98/8/EC or Regulation (EU) No 528/2012 (May 2015)[8]. These products contain altogether 9 active substances. The active substances and authorised uses are presented in Appendix IV.

<u>Use #1 - Protection of wood wooden railway sleepers (UC 3)</u>

There are 22 authorised products to be used for protection of wood in use class 3. None of the authorised products have been authorised for all uses intended for the creosote products in order to protect railway sleepers. Railway sleepers have been categorised as wood in use class 3 in the Competent Authority Report and in the emission scenario document (ESD) for wood preservatives (PT8). However, the applicants have claimed protection also against Soft rot. Efficacy against Soft rot is mandatory for UC4 preservatives according to EN 599-1:2009 but not for wood preservatives intended for protection of wood in use class 3. It could therefore be argued that a wood preservative aimed for protection of UC 4 wood would be more suitable for

[8] Since May 2015 a few more wood preservatives have been authorised in Sweden. These products contain no new active substances not already present in previously authorised products.

treatment of railway sleepers. There are, however, so far no suitable UC 4 preservative products that have been authorised under BPR or BPD which could substitute the creosote products.

Also, if the minimum efficacy requirements according to EN standard 599 for UC3 wood preservatives would be sufficient for protection of railway sleepers, there are only six such authorised products which are intended for penetrative application methods similar to the creosote products, see Appendix IV. All of these products include propiconazole as the only active substance. This means that the chemical diversity is not adequate concerning wood preservatives intended for protection of wood in UC3 using penetrative application methods.

Use #2 – Protection of wood in use class 4 - wooden posts and poles for transmission lines

There is only one authorised product in Sweden intended to be used for protection of wood in use class 4. This product is only intended for curative treatment of wood and is not an alternative to the creosote products.

Use #3 – Protection of wood in use class 5 – marine installations

There are so far no authorised biocidal products in Sweden aimed for protection of wood in UC 5.

Conclusion: There are so far no products in Sweden that have been authorised under BPR or BPD which can replace the creosote products in order to protect wooden railway sleepers or wood in UC 4 and UC 5.

Alternative wood preservatives that are not authorised under BPR or BPD but allowed to be on the market due to transitional rules in BPR are addressed below in section 1.8.

1.6 Tier I. Comparison to other authorised BPs

Tier I-B– "Quantitative" analysis: BPs containing an active substance meeting the exclusion criteria

Products containing an active substance meeting an exclusion criteria should according to the guidance document on comparative assessment be subject to a detailed comparative assessment whether there is adequate chemical diversity or not. In so doing, the use of that product could be restricted or prohibited if products, with the same active substances - mode of action combination and with a better profile are available.

Conclusion: A comparison according to Tier I-B is not possible since there are no products containing creosote that have been authorised under BPR or BPD.

1.7 Tier II. Comparison to non-chemical alternatives

Information on non-chemical alternatives are to be collected during the public consultation carried out by ECHA in connection with the approval or renewal of an active substance which is a candidate for substitution, Article 10(3) of the BPR. According to the guidance document on comparative assessment should no further public consultation be required. As creosote was approved as an active substance for use in wood preservative under the BPD a public consultation by ECHA has not been performed. However, as given above under documentation, a stakeholder consultation on creosote, commissioned by the EU Commission, was performed in 2008.

For a non-chemical alternative to be considered as an alternative for a use intended for the creosote products, the non-chemical alternative must according to Article 23(3)(a) of the BPR meet the following requirements:

- It shall already exist.
- It shall be sufficiently effective and present no other significant economic or practical disadvantages.

This excludes, according to the guidance document on comparative assessment those methods which still are in an early development phase or have not demonstrated sufficient effectiveness under field conditions.

The main focus in this assessment have been to consider potential non-chemical alternatives to creosote treated wood that are suitable for use in Sweden and which concerns the following uses:

- Railway sleepers
- Poles for transmission lines (electricity and telephone lines)
- Fence posts to be used in the agricultural sector
- Marine installations

1.7.1 Possible alternative materials to be used for railway sleepers

According to information from The Swedish Transport Administration the only types of railway sleepers used in Sweden are concrete and wooden sleepers. About 70 % of the railway network in Sweden today consist of concrete sleepers. Concrete sleepers are also used when new lines are established and for replacement of wooden sleepers if this is needed due to demands on higher loads or higher speeds. The remaining 30 % of the railway network is equipped with wooden sleepers and for the most part of creosote impregnated wooden sleepers (about 7 million sleepers).

The wooden lines are often secondary tracks and low trafficked lines situated in sparsely populated areas but they play an important role in the transport system especially for freight traffic and regional transport.

In order to maintain the existing wooden lines by replacing individual worn out sleepers, sleepers with the same characteristics must be available since sleepers with different technical properties cannot be mixed on the same line. Standard concrete sleepers are therefore not an option as replacement of single creosote sleepers. Around 60 000 new creosote sleepers are used every year for replacement of damaged wooden sleepers[9]. According to The Swedish Transport Administration it is not economically feasible, either in the short or medium term, to substitute all wooden sleepers with concrete sleepers. The cost for such upgrading was in 2008 estimated to be 550 Euro per track meter.

The Swedish Transport Administration has studied the possibility of using other alternatives to creosote treated sleepers. In a compilation[10] of possible alternatives, the alternatives are described and ranked regarding materials, method, function in track, environmental impact and cost. Two types of sleepers were ranked as priority one and further studied in a life cycle assessment (LCA II, Appendix V).

- Tuned Concrete Sleeper (TCS) – a concrete sleeper with wood characteristics. The TCS-sleeper consist mainly of concrete and stainless steel reinforcement and has been developed in order to serve as replacement sleepers to wooden sleepers.
- Linseed oil sleepers – a pine sleeper impregnated with a linseed oil based impregnation.

A creosote impregnated pine sleeper was included in the study as a reference alternative. The TCS-sleepers have an assumed life span of 50 years, the linseed oil sleepers 20 years while creosote sleepers have an assumed life span of 35 years.

The conclusion from the LCA is that there is no coherent picture of which of the three sleeper types has the least negative impact on the objectives studied; impact on the climate, health and ecotoxicological effects. The TCS-sleeper has, according to the LCA, low toxicity in track but have negative impacts on both human health (stainless steel reinforcement) and the marine

[9] Information from the Swedish Transport Administration.

[10] The Swedish transport administration (railway) has made a survey over possible alternatives (Jan Schmidtbauer Crona, Studio CRONA AB & Melica 2012). The survey is presented in Appendix X in connection with the LCA No. II.

ecosystems during the material production. The effect of linseed oil sleepers is, according to the LCA, around three and thirteen times higher for aquatic systems and soil, respectively, compared to the impact of creosote sleepers (using WEI Type B creosote). The negative effects of the linseed oil origin from two biocidal substances[11] present in the oil. A more comprehensive summary of the LCA and its results is given in Appendix V.

In 2013, a test using 1500 TCS-sleepers was performed. The overall conclusion from a contractor, working on behalf of the Swedish Transport Administration with managing the operation and maintenance of the railway as well as with rebuilding and new construction of railway, is that the TCS-sleeper is a promising alternative to creosote treated sleepers. They have based on their experience summarized some advantages and disadvantages with the TCS-sleepers in comparison with creosote treated sleepers:

Advantages:

- Better working environment for workers handling the TCS-sleepers compared to creosote treated sleepers, for example less risks for skin problems and risks/concerns about cancer.
- Lower costs for the logistics concerning planning of suitable places for storage of the sleepers in order to avoid pollution or smell problem for the surroundings.

Disadvantages:

- The TCS-sleeper is heavier, about 175 kg compared to around 50 – 70 kg for a creosote sleeper. This could lead to a slightly higher risk of crush injuries.
- Some technical problems with the fixings on the sleepers but this should probably be resolved in the near future.
- TCS-sleeper is more expensive than a creosote sleeper. The price would probably be lower if it was produced in larger quantities.

The Swedish Chemicals Agency has further received information from manufacturers of alternative materials to be used for railway sleepers such as plastic and wood treated with alternative methods, see Appendix II. These alternative materials have however not been tested in Sweden yet. According to information from the Swedish Transport Administration will they continue to test and evaluate the TCS-sleeper as well as other alternatives to creosote treated sleepers. Plastic sleepers, other types of concrete sleepers and sleepers treated with creosote-free wood preservatives are examples of alternatives that may be part of upcoming tests.

11 [redacted]

Conclusion: In order to maintain the existing wooden lines by replacement of damaged creosote wooden sleepers there is a prerequisite for sleepers having the same technical properties as wooden sleepers. According to the Swedish Transport Administration are there currently no established alternative to creosote-treated railway sleepers.

1.7.2 Alternative materials for utility poles to be used for electric power transmission and telecommunication

It has been estimated that there are seven millions wooden poles in Sweden used for both power transmission and telecommunications. One of the main actors concerning telecommunication in Sweden, Skanova[12], has about 2.3 million of wooden poles in use in their network. The main part consist of poles impregnated with salt-based wood preservatives. The Swedish Chemicals Agency has no indication of what percentage of these that are impregnated with former allowed CCA[13] wood preservatives. Vattenfall AB which is owned by the Swedish government and one of Europe's largest generators of electricity, has about 925 000 wooden poles in use in Sweden of which two thirds are creosote treated poles.

Information submitted by the applicant concerning poles made of alternative materials

Concrete poles

-Cast concrete poles are manufactured by pouring concrete into a tapered form with a square, polygon or H-Section. Pre-stressed steel stands are also typically included to increase the strength and resistance to bending. This type of pole can be considered maintenance free but there remains some concerns surrounding long-term corrosion of the reinforcing bars. Further, due to the presence of reinforcing bars, the poles are in general electrically earthed throughout length, which leads to a reduction in the electrical transient performance of the overhead line attributable to the inherent reduction in the basic impulse level. The poles are considerably heavier than the equivalent wood poles and as such their use is generally restricted to environments where there is good vehicular access.

-Spun Concrete poles are similar in characteristics to cast concrete poles but are circular in cross section and have a hollow interior. For a given strength spun concrete weighs less than cast concrete, particularly as height and transverse loading capacity increase. Spun concrete poles have the additional advantages that they are round in profile and thereby less affected by wind. The spun concrete poles are however more expensive than cast concrete poles. Spun concrete poles

12 Telia Sonera Skanova Access AB.
13 CCA - Chromated Copper Arsenate.

have been available on the market for 40 years, they are however not universally used. There are wide variations between individual companies and countries. The reasons for this are primarily the increased financial cost and physical weight of concrete poles compared to wood poles. In addition, like cast concrete poles, spun concrete poles cause a reduced electrical transient performance on the overhead line due to the need for them to be earthed. From the survey of end users there is no evidence that the scope of their application will increase.

Steel poles

Steel poles have been widely available on the market for 40 years. The use of steel poles is not uniformly distributed amongst Member States. In some Member States they are used extensively but in others the use is limited to a few specialist applications; representing less than 1% of total pole usage. The reasons for their piecemeal use are primarily the increased financial cost and physical weight of steel poles compared to wood poles equivalents. Steel poles are, however, more commonly used at transmission voltages where much higher structures are required than can be catered for by wood poles.

Poles made of laminated wood

These poles are manufactured by gluing together stripes of wood into the form of a tapered pole with a square cross section. The poles are generally lighter than the equivalent solid round pole, having less variability in strength. A laminated pole can be climbed with the same equipment as round wood poles. However, this type of pole is expensive and has a less desirable profile for wind loading calculations. More generally this type of pole is used within aesthetic applications such as street lightning. Its use in power system applications remains negligible and no technological development is currently underway which will meaningfully change its profile of use.

Poles made of Polymer Composite Fibre Reinforced Steel (PCFRS)

This type of poles remains at the early experimental stage. In essence this type of pole considers the possibility of mitigation of corrosion problems related to the steel reinforcement in concrete poles by replacing this element with glass fibre-reinforced polymer composite material. This type of structure has not yet been taken to a commercial level. Initial technical findings have been varied with trial poles exhibiting high bending under load.

Steel Hybrid poles

This type of structure refers to a steel pole mounted on a concrete foundation. This has several advantages; firstly the concrete foundation is not susceptible to corrosion, secondly the pole is in two pieces thereby reducing individual installation weights negating the need for a heavy-duty crane. However, the disadvantages associated with steel poles remain: expensive, different climb-ability and low basic impulse levels. In addition extensive ground works are required which significantly increases installation costs. The extent of its application on existing networks is negligible and is generally restricted to transmission networks.

Aluminium poles

Although aluminium is sometimes used in light duty applications such as street lighting columns, it is rare in power transmission or distribution application. This is primarily due to poor strength to weight properties of aluminium compared to alternatives such as steel. It is not considered viable for use in power and telecommunications networks in future.

Stainless Steel poles

Stainless steel poles have some use in specialist applications particularly on telecommunication networks in locations where there is a requirement for un-stayed angle support in village networks. This however, is restricted to only the lightest duty applications and would not be viable for power distribution networks where much higher mechanical load are developed. In addition due to their high cost, these poles could not be more widely used in telecommunication networks.

Composite poles

Composite poles are manufactured by injecting epoxy resin into a matrix of reinforcing fibres such as fibreglass, carbon fibre or Kevlar. The result is a high strength to weight ratio, with no susceptibility to corrosion. The weight of a composite pole is slightly lower than a wood pole. Composite poles exhibit a high electrical basic impulse but concerns remain as to their UV stability and workability on site. From published data and response from end users with service experience, the service life will lie between 20 and 60 years. At current time composite poles are used in areas with restricted access or where woodpecker damage is prevalent. They remain expensive when compared to wood poles and as such are used in specialist site-specific applications. Therefore in Europe, the use of fibreglass poles is a relatively unproven technology in comparison to equivalent steel and concrete poles. Evidence gathered from end users has established that research work is ongoing to address these concerns but is not yet at a level where the widespread application of fibreglass poles in preference to creosote treated wood poles can be considered viable.

Information about composite poles as an alternative to creosote treated poles submitted by manufacturers.

The Swedish Chemicals Agency has received the following information from two manufactures of composite poles:

Jerol composite pole - consist of glassfibre reinforced polyester with a polyethylene coating, containing UV filters. According to the manufacturer Jerol Industri over 3000 composite poles for electrical and telecom distribution have been delivered and installed since late 2010, to around 50 customers in 70 different projects in Sweden, Norway, Finland and the UK (December 2013). The poles can be manufactured in lengths from a few meters up to 24m. The Jerol pole is half the weight of the wooden pole. The manufacturer stated that it is possible to work with almost exactly the same working methods and equipment as with wooden poles. They also stated that the Jerol pole has a long lifespan (min 80 years) and low maintenance cost. Poles, without the polyethylene protection, have been standing since the beginning of 1960's in ruff coastal environment in southern Finland according to the manufacturer.

R/S composite poles – glassfibre bound together with two types of polyurethane resin, an aromatic polyurethane resin and a UV stable aliphatic resin. The end product is a composite, fibre-reinforced polymer pole. According to the manufacturer, Melbye Skandinavia Sverige AB, the poles come in lengths from 9.14 m to 47.24 m. RS poles can be used for distribution, transmission and telecommunication applications. The manufacturer states that, in general, the RS poles are approximately 2/3 the weight of steel, 1/3 the weight of wood and 1/8 the weight of concrete poles resulting in the highest strength-to-weight ratio of any pole material in the industry. The 80 year service life of RS poles means that the cost for maintenance is lower compared to the wooden poles. The R/S composite pole have been used for a 140 kilometres transmission line in Norway and used in Sweden in three smaller projects, for instance in a drinking water protected area.

Impact on human health and environment from utility poles of different materials.

In a life cycle analysis (LCA)[14] a comparison was made between wooden poles treated with creosote, concrete poles, steel poles and composite poles. The impact of each material on the environmental categories climate change, eutrophication, acidification, ground level ozone, ecotoxicity and human health was analysed and compared.

[14] See LCA I, Appendix XI.

The results of this LCA shows that the most significant environmental aspect is emissions of metals from steel poles during the life cycle, which has an impact on both ecotoxicity and human toxicity in the analysis. The steel pole was also the pole which had the largest contribution to other environmental impact categories. Composite poles have generally similar environmental performance to concrete poles but concrete poles have greater impact on eutrophication while composite poles have greater impact on climate change. Creosote poles and concrete poles do not differ that much with regard to the aspects studied in the LCA. Concrete poles contribute more to climate change and eutrophication, while creosote treated wood has a higher impact on photochemical ozone formation and human and ecological toxicity[15] [16].

It should be noted that LCA studies do not include all aspect that may have an impact on human health and environment. Also, regional differences can change the outcome of such studies.

Experiences and remarks from end users

Vattenfall AB has started a coherent project to study and in practice test alternative poles, aiming at having a well-functioning and proven alternative to creosote impregnated poles in 2018. The project was started in May 2013, and the focus is to evaluate the alternatives to creosote impregnated poles, which are available on the market and can be used in the Vattenfall networks. Constructions with alternative materials (test projects) have also been built. Objective reports and reviews are not yet available regarding alternative materials. Cooperation with other actors has been initiated to jointly approach some of the issues. The alternatives of poles are evaluated based on technology, environment, occupational health and safety and economy, where relevant aspects within each category have been developed. Every aspect of the pole is evaluated and rated based on a weighted relevance to the aspect. The most challenging aspects of the project are that detailed and objective knowledge about properties of the alternative poles need to be evaluated over a longer time period (to make conclusions for the whole life cycle). Alternatives need a compliance (according to standards and working practice at Vattenfall) within network operations and industry methods to build, construct and maintain the electricity network sector in order to plan and execute projects. In any case, the production capacity of the suppliers is currently not adequate according to Vattenfall, especially in the context of supplying the whole business with alternative poles. At the present time the cost of these alternatives is also considered prohibitive by Vattenfall.

[15] It builds on the assumption that only 5% of emitted chromium from cement is hexavalent and the rest trivalent chromium. If the content of hexavalent chromium is higher, then the impact from concrete poles will be worse.
[16] The impact of the creosote poles on human toxicity depends to great extent on the content of naphthalene in the creosote formulation.

Skanova considers that creosote poles are the only realistic alternative for a foreseeable future. There are still question marks for alternative poles regarding quality, service life, environmental aspects, working conditions including safety aspects and economy. The strategy for Skanova is to reduce the need for new poles. The need for new poles is restricted to the exchange of old poles at the end of their service life. Skanova is continuously looking at alternative materials, alternative preservatives, increase of underground networks, further shift to wireless techniques and reuse of old poles. The market with respect to alternatives fulfilling the needs of Skanova is still premature. Alternatives may have higher as well as lower impact on different environmental and health categories. The alternative solutions have to be economically reasonable, they have to fulfil the demands of Skanova regarding working conditions including safety aspects (e.g during climbing). Furthermore, they shall preferably affect the current working practices and processes as little as possible. Skanova have performed tests with two types of alternative poles: a pole made of bambu reinforced polyethene and a composite pole (glass fibre reinforced polyester with a polyethylene coating). The bambu reinforced polyethene poles showed however less good results in a durability test and further evaluation of the poles was therefore stopped. A better constructed pole may be provided by the supplier. Concerning the composite pole, there remains some uncertainty in terms of the working environment (climbing) and handling of the poles.

Conclusion: The Swedish Chemicals has received information about a number of potential alternative poles, for instance composite poles, to be used for electric power transmission and telecommunication instead of creosote treated poles. According to end users the alternative poles are not yet sufficiently tested or are not economically reasonable. Furthermore, the submitted LCA:s do not give a coherent picture of which of the alternative material or creosote treated wood that has the least negative impact on studied environment and health factors.

1.7.3 Alternative materials for fence posts for use in the agricultural sector

The Swedish Chemicals Agency has limited knowledge on the extent to which creosote treated wooden posts are used for fencing in Sweden. The creosote products, authorised in Sweden under national rules, are not authorised for treatment of wood to be used for fence posts. The applicant has not submitted any information which addresses the situation in Sweden concerning the current use or need of creosote treated posts. In order to gain information on which types of fence posts that are marketed in Sweden, a search on the internet was performed. According to the search result, the following materials are available, besides wood treated with alternative wood preservatives, for fence posts in the agricultural sector; metal (galvanised iron, steel etc.), naturally resistant wood (e.g. acacia), plastics (recycled, PVC etc.) and glass fibre posts. Creosote treated wooden posts seems to be marketed only by a few suppliers.

According to the information summarised in a report by the German Competent Authority (BauA), metal posts (steel, galvanised iron etc.) are routinely used in the agricultural sector since they are particularly long-lasting. However, in view of their weight, they are not suitable to be used on steep slopes. Another disadvantage is that they release zinc into the environment. Concrete posts are also used in various agricultural sectors. Their use is limited by the specific properties of concrete such as; risk for fracture, heavy weight, need for cross-bracing above a certain height. Concrete posts are not suitable for steep slopes either. Acacia posts are due to stability reasons not suitable for use as end post under tension.

According to the applicant fully suitable or adequately tested alternative wood preservatives, other wood preservation processes or alternative materials are not yet available for agricultural purposes.

Conclusion: Protection of wood to be used for fence posts has so far not been an authorised use in Sweden for creosote products authorised under national rules. The applicant has not submitted any analysis regarding the situation in Sweden concerning the need of creosote treated fence posts. Alternative materials are available and in use in Sweden.

1.7.4 Alternative materials for use in marine installations

The Swedish Chemicals Agency has very limited information on the extent to which creosote treated wood are used in different marine installations, such as wharfing and piling, compared to other materials. The applicant has not submitted any specific information concerning the situation in Sweden. Neither has information concerning marine constructions been submitted by other stakeholders such as manufactures of alternative materials or by end users. The Swedish Chemicals Agency has contacted two entrepreneurs in Sweden, situated at the west coast, working with installations of marine installations such as piling. One of the entrepreneur's uses mainly piles of steel lined with plastic tubes which are filled with concrete. This method has according to them advantages compared to traditional wooden piles, for instance a longer life span compared to wooden constructions. The other entrepreneur uses wooden piles with the main part being treated with salt-based wood preservatives. Alternative wood preservatives not authorised under BPR or BPD are further addressed below.

The Swedish Chemicals Agency is aware that this small investigation does give a complete picture of which materials that are used for marine installations in Sweden. According to the applicant there would be a greater pressure on naturally durable species often sourced from sensitive tropical forests if creosote is not available for marine uses. The Swedish Chemicals Agency is not aware on the extent to which naturally durable wood is used in marine structures in Sweden.

Conclusion: The applicant has not submitted any analysis concerning the situation in Sweden, addressing the need of creosote treated wood to be used for marine applications. Alternative materials as described above seem to be available.

1.8 Wood treated with alternative wood preservatives not authorised under BPR or BPD

It is stated in the guidance document on comparative assessment that only products authorised under the BPD or BPR shall be subject for comparison. However, biocidal products including active substances for which a decision of approval has been made or active substances included in the work programme for relevant product type may still be used for treatment of articles due to transitional rules in the BPR.

In Sweden, wood preservatives covered by the transitional measures in Article 89(2) of the BPR must be authorised according to national rules in order to be available on the Swedish market or used. Currently there are thirteen products authorised under national rules in Sweden intended for treatment of UC 3 wood. Nine of them are also intended for treatment of UC 4 wood. All products intended for treatment of UC 4 wood are so called salt-based products and include at least one of the following copper compounds as an active substance; Cu-HDO, Cu-hydroxide, Cu-hydroxide-carbonate (1:1) and Cu-oxide. Other active substances used in combination with the copper compounds are quaternary ammonium compounds, boric acid, propiconazole and tebuconazole.

Considering the health risks with the alternative wood preservatives, it can be concluded that the active substances in salt-based wood preservatives display a lower health risks than creosote with regard to mutagenic and carcinogenic properties. Boric acid as well as creosote is classified as toxic to reproduction, boric acid in category 2 and creosote in category 3. Concerning risks to the environment, most of the alternative substances have like creosote harmful effects on non-target organisms. Copper compounds have a high accumulation potential in particularly soil which needs to be considered. Tebuconazole is due to its classification as very persistent (vP) and toxic (T) regarded as a candidate for substitution under the BPR. Tebuconazole, as well as propiconazole, is furthermore suspected of having endocrine effects. It should further be noted that the formulation of alternative products may contain substituents with the potential of having harmful effects on human health and environment. Chromium (VI) trioxide for instance, which is included in one of the authorised wood preservatives in Sweden, is classified as carcinogenic, mutagenic and toxic to reproduction.

Use of alternative wood preservative for protection of wooden railway sleepers

The Swedish Transport Administration has tested other wood preservatives to be used for protection of railway sleepers but has so far not found a suitable alternative that corresponds to the demands in question of life span and costs. Previously CCA wood preservatives have been used in Sweden besides creosote for protection of railway sleepers. Swedish Chemicals Agency has received information from manufacturers of alternative wood preservatives, see Appendix II. These reported alternatives have however not been sufficiently tested yet and cannot at the present time be regarded as a potential alternative to the creosote products.

Conclusion: There are according to end users no alternative wood preservatives which at the present time can replace creosote products for treatment of wooden sleepers. Wooden sleepers treated with alternative wood preservatives have a shorter life span which has a negative effect on the costs.

Use of alternative wood preservatives for protection of wooden poles for telecommunication and power supply

The life span of poles treated with current available salt-based wood preservatives is according to the applicant and end users shorter compared to creosote treated poles. However, according to the report from DE CA is the field of utility poles in Germany dominated by impregnation with salt-based wood preservatives. The Swedish Chemicals Agency has no information about which types of salt-based preservatives have been used. DE CA has further reported about a modification of the pole treatment with salt-based wood preservatives by placing bandages around the pole at the transition zone from soil to air. This zone is particularly prone to attack by organisms that cause the wood to decompose. This can be done as a precautionary or remedial measure. Bandages currently on the market consist of either a carrier material impregnated with wood preservative or a combined metal and plastic film. According to some manufacturers, bandages can extend service life by up to 40 years. The Swedish Chemicals Agency is not aware of whether this method has been tested also in Sweden.

Conclusion: Wooden poles treated with alternative wood preservatives have according to end users a shorter life span compared to creosote treated poles. This results in a negative effect on the costs.

Wooden fence posts for use in the agricultural sector

Wooden fence posts treated with salt-based wood preservatives seem to be commonly used in Sweden. According to the applicant, salt-based wood preservatives may not always give a sufficient protection in order to meet the special requirements of specific crops in for instance the wine and fruit-growing sectors. Problems arise in particular from copper-resistant moulds in the soil, which severely limits the use of wood preservatives with copper salts for certain crops. The applicant stated that the end users therefore value posts with a creosote-impregnated base because of their long life and durability in the face of copper-resistant moulds. The Swedish Chemicals Agency has no information on the extent to which copper-resistant moulds occur in Sweden.

Conclusion: Wooden posts treated with alternative (salt-based) wood preservatives are to the knowledge of the Swedish Chemicals Agency commonly used in Sweden.

Wood used for marine installations

There are currently no alternative wood preservatives in Sweden, authorised under national rules, intended for treatment of wood for use in marine installations. One of the authorised salt-based products which is authorised for treatment of wood in UC 4 has though been classified as suitable also for treatment of UC 5 wood by the Nordic Wood Preservation Council (NTR). Protection of wood used in wharfing and other marine structures is according to the applicant a challenge for most preservatives in most EU coastal waters except for creosote products. Copper is the only component in copper organic preservatives that might have a reasonable life when exposed in the sea but protection against *Teredo navalis* and *Limnoria spp* is inadequate according to the applicant. However, as reported above, an entrepreneur in Sweden, working with installations of marine installations, uses mainly wood treated with salt-based wood preservatives. One reason is that the workers are hesitant to work with creosote treated wood. It should be noted that it is possible to purchase wood treated with alternative wood preservatives from other countries, if available, as long as the treated wood comply with the rules in the BPR for treated articles.

Conclusion: There are currently no alternative wood preservatives in Sweden, authorised under national rules, intended for treatment of wood for use in marine installations.

1.9 Overall conclusion

Use 1 - Use of creosote products for treatment of wood to be used for railway sleepers

The result from the screening phase showed that there are so far no suitable wood preservatives in Sweden which have been authorised under BPR or BPD that could be used for protection of wooden railway sleepers. A comparison according to Tier I-B is not possible since there are no products containing creosote that have been authorised under BPR or BPD.

The Swedish Chemicals Agency has received information about a number of non-chemical alternative materials that are used for railway sleepers. However, these railway sleepers have according to end users not been sufficiently tested in Sweden yet. Creosote treated wooden sleepers are used in order to maintain the existing wooden lines by single replacement of damaged creosote wooden sleepers. It is important that all sleepers on a track have the same technical properties. There are according to end users no available alternative wooden sleepers which meet their requirements at the present time. It should be noted that a railway line represents a safety-critical field where confidence in performance and long service life of sleepers is important.

The Swedish Chemicals Agency cannot, based on this assessment, exclude that a prohibition of creosote products used for protection of railway sleepers could lead to significant economic or practical disadvantages for end users. The criteria in Article 23 are not met according to this assessment, and therefore a prohibition based on that article is not possible. The analysis shows that there are no appropriate alternatives in Sweden to creosote products for this use. This use should therefore not be prohibited or restricted based on this comparative assessment and the specific provision for creosote.

Use 2 - Use of creosote products for treatment of wood to be used for poles (electric power transmission and telecommunications)

The result from the screening phase showed that there are so far no suitable wood preservatives in Sweden, which have been authorised under BPR or BPD, for protection of wooden poles to be used for electric power transmission and telecommunications. A comparison according to Tier I-B is not possible since there are no products containing creosote that have been authorised under BPR or BPD.

Several alternative materials used for poles are presented in this report. According to end users alternative poles which may have the potential to substitute creosote treated wooden poles are not economically reasonable or are not yet sufficiently tested in Sweden. Poles used for electric power transmission and telecommunication represent a safety-critical use where confidence in performance and long service life is important. Furthermore, the submitted LCA:s do not give a coherent picture of which of the alternative material or creosote treated wood has the least negative impact on the studied environmental and health factors.

The Swedish Chemicals Agency cannot exclude that a prohibition of creosote products for use as protection of wooden poles for electric power transmission and telecommunications could lead to significant economic or practical disadvantages for end users. The criteria in Article 23 are not met according to this assessment, and therefore a prohibition based on that article is not possible. The analysis shows that there are no appropriate alternatives in Sweden to creosote products for this use. This use should therefore not be prohibited or restricted based on this comparative assessment and the specific provision for creosote.

Use 3 - Use of creosote products for treatment of wood in to be used for fence posts in the agricultural sector

There are so far no authorised wood preservatives in Sweden, authorised under BPR or BPD, which are intended for treatment of wood in UC 4, e.g. fence posts. A comparison according to Tier I-B is not possible since there are no products containing creosote that have been authorised under BPR or BPD.

The majority of fence posts used in Sweden in the agricultural sector seems to be made of alternative non-chemical materials or wood treated with alternative wood preservatives. It should be noted that treatment of wood to be used for fence posts is a new use in Sweden for creosote products. The applicant has not submitted an analysis regarding the situation in Sweden concerning the need of creosote treated wooden posts. Therefore, the Swedish Chemicals Agency cannot conclude that a prohibition of creosote products for use as protection of poles for use in the agricultural sector would lead to significant economic or practical disadvantages for end users.

The criteria in Article 23 are not met according to this assessment, and therefore a prohibition based on that article is not possible. However, the analysis shows that there seem to be appropriate alternatives in Sweden to creosote products for this use. This use should therefore, based on this comparative assessment and the specific provision for creosote, not be authorised in Sweden.

Use 4 - Use of creosote products for treatment of wood to be used for marine applications.

There are so far no authorised wood preservatives in Sweden, authorised under BPR or BPD, which are intended for treatment of wood to be used for marine applications (UC 5). A comparison according to Tier I-B is not possible since there are no products containing creosote that have been authorised under BPR or BPD.

The Swedish Chemicals Agency is not aware of a significant need of creosote treated wood to be used for marine applications in Sweden. Alternative materials are available and in use in Sweden according to information from end users. The applicant has not submitted an analysis regarding the situation in Sweden regarding the need of creosote treated wood for use in marine installations which is required due to the specific provision in the inclusion directive for creosote. Therefore, the Swedish Chemicals Agency cannot conclude that a prohibition of creosote products for use as protection of wood intended for marine applications would lead to significant economic or practical disadvantages for end users.

The criteria in Article 23 are not met according to this assessment, and therefore a prohibition based on that article is not possible. However, the analysis shows that there seem to be appropriate alternatives in Sweden to creosote products for this use. This use should therefore, based on this comparative assessment and the specific provision for creosote, not be authorised in Sweden.

It should also be considered that the PEC/PNEC ratios for surface water in the marine environment are well above 1 even with degradation and adsorption taken into account (TIME 1 and TIME 2).

Appendixes

Appendix I – Reference list - documentation submitted by the Applicant

Authors	Year	References	Owner
AquAeTer	2013	1. Conclusions and Summary Report on an Environmental Life Cycle Assessment of ACQ-Treated Lumber Decking with Comparisons to Wood Plastic Composite Decking, Prepared by: AquAeTer, Inc. © Treated Wood Council (2012). 2. Conclusions and Summary Report on an Environmental Life Cycle Assessment of Borate-Treated Lumber Structural Framing with Comparisons to Galvanized Steel Framing. ISO 14044 Compliant. Prepared by: AquAeTer, Inc. © Treated Wood Council (2012). 3. Life Cycle Assessment Procedures and Findings for Creosote-Treated Railroad Ties. Prepared by: AquAeTer, Inc. Treated Wood Council (2013). 4. Conclusions and Summary Report Environmental Life Cycle Assessment of Highway Guard Rail Posts. ISO 14044 Compliant. Prepared by: AquAeTer, Inc. © Treated Wood Council (2013). 5. Conclusions and Summary Report Environmental Life Cycle Assessment of Marine Pilings. ISO 14044 compliant. Prepared by: AquAeTer, Inc. © Treated Wood Council (2012). 6. Conclusions and Summary Report on an Environmental Life Cycle Assessment of Utility Poles ISO 14044 compliant. Prepared by: AquAeTer, Inc. © Treated Wood Council (2012)	Treated Wood Council
International Union of Railways (UIC)	2013	SUWOS: Sustainable Wooden railway Sleepers	UIC
Kohler M., Künniger T., Schmid P., Gujer E., Crockett R., Wolfensberger M.	2000	Inventory and emission factors of creosote, Polycyclic Aromatic hydrocarbons (PAH), and Phenols from Railroad Ties Treated with Creosote. Environmental Science & Technology (2000), 34, 4766-4772	EMPA

Kohler M., Künniger T.	2003	Emissions of polycyclic aromatic hydrocarbons (PAH) from creosoted railroad ties and their relevance for lice cycle assessment (LCA) Holz als Roh- und Werkstoff 61 (2003) page 117-124	EMPA
Werner F.	2008/2009	Life cycle assessment (LCA) of railway sleepers Comparison of railway sleepers made from concrete, steel, beech wood and oak wood	Studiengesellschaft Holzsch-wellenoberbau e.V.
Erlandsson M., Almemark M.	2009	Background data and assumptions made for an LCA on creosote poles	IVL
Coggins C.R.	2013	Technical feasibility of substitution of creosote for the treatment of wood for poles, sleepers, fencing, agricultural uses (including tree stakes), fresh and sea water uses and professional use in the context of application for authorisation of creosote in accordance with the Biocidal Products Directive	WoodPro Consulting
Borrie D.	2013	Socio Economic Case for the Continued Use of Creosote as a Wood Preservative for Wood Poles V1.4	WEI Brussels

Appendix II - The Swedish Chemicals Agency's request for information about alternatives to creosote

The Swedish Chemicals Agency is collecting information about alternatives to creosote

4 November 2013

The Swedish Chemicals Agency is currently evaluating applications for authorisation of biocidal products containing creosote in Sweden. In this process, we are interested in obtaining information about alternatives to creosote. Creosote is primarily used as a wood preservative in power supply poles, telephone poles and railroad ties. Anyone who has information about alternatives is welcome to contact us.

Alternatives to creosote could be other wood preservatives but it can also be a different method or technique.

We would like the information to include the following aspects:

- Risks to the environment and health (the analysis should include the entire life cycle, from production to disposal)
- Efficacy
- Long-term sustainability
- Practical usability (For example: information on whether the alternative will lead to new needs for equipment when it comes to mounting and climbing, or new needs for roads to access necessary areas with heavier vehicles; if it is possible to replace single poles and sleepers or if long sections of poles and sleepers have to be replaced at the same time; if the ballast under railroad sleepers need to be strengthened; how the function of railroad switches will be affected.)
- Impact on noise levels (e.g. the risk of noise pollution in urban areas)
- Economy
- Production
- Contingency (e.g. during storms when large numbers of power poles and telephone poles may need to be replaced)
- User acceptance and user experience
- Safety (e.g. when climbing poles)

This information will be shared with other countries in the European Union and with the European Chemicals Agency, ECHA. Therefore we would like the information to be written in English. We would like to ask those who wish to submit information to please do so before 31 December 2013. Please send it to kemi@kemi.se with the reference number: H13-02140.

End of KemI request.

Contributions, see Table A-III below, were received from both manufacturers of potential alternatives, national government and stakeholders, see Table below. The contributions ranged from short emails to more ambitious descriptions, and included contributions from companies representing other wood preservatives (copper-based), and contributions from companies representing other materials (concrete, composite, as well as other techniques (heating of wood). The contributions were most often focused on poles or sleepers.

Table. A-III – Submitted information concerning alternatives to creosote.

	Sender	**Role**	**Information**
1	Nordic Wood Preservation Council	Industry association	-Several life cycle analysis (LCA:s) which compares treated wood with other materials. -A powerpoint presentation: "Wooden poles – Alternatives to creosote for preservative treatment" from Jöran Jermer, SP Wood Technology
6	SEKISUI Chemical GmbH	Producer of railway sleepers	Information about railway sleepers made from Glasfibres and Polyurethan which were mainly used in Japan for bridges, turnouts and special railways application. Since the production started about 30 years ago more than 2.000.000 pcs with a track length of more than 1.200 kilometres have been installed in Japan. The European market was entered 2004 and the approval processes is running in several EU countries.
	Abetong Ab	Producer of railway sleeper	Information about Tuned Concrete Sleeper (TCS-sleeper).
7	Svenska Reimpregnerings AB lavTOX	Producer of wood preservatives	Information about an alternative wood preservative, Boron Rod, to use as a secondary treatment for wooden poles in service, or as preventive treatment, with the aim to prolong the life span.

8	Imprägnierwerk Wülknitz GmbH	Producer of creosote impregnated wood	The producer has looked into the using of alternative wood preservatives in the last years and has also developed a patented more environment-frienly wood preservative on the basis of creosote and [redacted] But to their experience only creosote has a very good efficiency against insects, fungus or termites and creosoted products have a very long life-time under various climate conditions.
9	Melbye Skandinavia Sverige AB	Producer of composite poles	Information about composite poles (R/S composite poles.
10	DAUERHOLZ AG	Producer of wood	Information about alternative wood treated with a wax component, food-safe paraffin wax. They are currently testing if their product could be an alternative to Creosote as well.
11	SNCF (French railways)	Public railway	Information that they have performed an analysis regarding creosote and possible alternatives.
12	Vattenfall Eldistribution AB	Power producer	The current view of Vattenfall regarding creosote and possible alternatives (poles). Powerpoint presentation.
13	Jerol Industri AB,	Producer of composite poles	Information about the Jerol composite pole.
14	Infranord AB	Entrepreneur working with operation, maintenance of railway and on construction.	Information about the TCS sleeper.
15	Osmose	Producer of wood preservatives	Osmose Timber Technologies has submitted information about an alternative wood preservative, SleeperProtect, which is an oily wood preservative based on OS-315. OS-315 contains active substances that are BPD/BPR compliant. Since April 2011 more than 5,000 test sleepers treated with SleeperProtect have been put in railway tracks across Europe in order to gain experience about their long term mechanical properties and efficacy in railroads. Osmose expects that these sleepers can be on the market 2018. The product could also be used for the treatment of other timber products e.g. poles.
17	Producer of creosote poles in Belgium CIBB	Producer of impregnated wood	Information about disadvantages with alternative wood preservatives and alternative materials compared to creosote treated wood for use to horse fences, fruit poles, agricultural poles.

19	Nordiska Träbehandlings AB	Producer and supplier of heat treatment chambers for timber.	Information about heat treated wood.
20	Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA)	National government	A summary regarding creosote and possible alternatives.
	Bundesanstalt für Arbeitsschutz und Arbeitsmedizin (BAuA)	National government	The health profiles of the creosote mixtures differs and needs to be considered. The Swedish Chemicals Agency aims to address this in the assessment report.
21	The Swedish Transport Administration (Trafikverket)	Public railways	An overview regarding creosote and possible alternatives.
22	Wood Protection Association	Industry association	A report regarding possible breakage of composite poles.
23-24	Skanova	Infrastructure company (overhead networks)	The current view of Skanova regarding creosote and possible alternatives (poles)

Appendix III – A summary of the outcome for the stakeholder consultation on creosote which was performed 2008 initiated by the EU Commission (CA-Sept08-Doc.8.4)

Acrobat Document

Appendix IV – Intended uses of wood preservatives authorised under BPD and BPR in Sweden sorted under the active substances, May 2015, Swedish Chemicals Agencys' Pesticide Register.

Active substances in authorised products	Number of products	Aim of application	Target organisms	Use class	Application method
boric acid	1	preventive	wood rotting fungi insects	1, 2	vacuum impregnation, dipping
	1	curative	wood rotting fungi	4	insertion
boric oxide disodium tetraborate	1	preventive	wood rotting fungi	2	rods for direct application
IPBC	1	preventive	blue stain	2, 3	superficial application
sulfuryl flouride	1	curative	wood destroying pests including termites, wood boring beetles and pinewood nematode.	-	fumigation
propiconazole	1	preventive	wood rotting fungi	2, 3, 3,1	vacuum impregnation
	2	preventive	wood rotting fungi discolouring fungi, *Serpula lacrymans*	2, 3, newly sawn timber	pressure/vacuum-impregnation, superficial application
	1	preventive	wood rotting fungi discolouring fungi,	2, 3	pressure/vacuum-impregnation
tebuconazole	2	preventive	wood rotting fungi	3	superficial application
propiconazole IPBC	2	preventive	blue stain	2, 3	superficial application
	4	preventive	wood rotting fungi blue stain	2, 3	superficial application
	2	preventive	wood rotting fungi blue stain	2, 3	superficial application vacuum impregnation
	1	preventive curative	wood rotting fungi blue stain mould	2, 3	superficial application

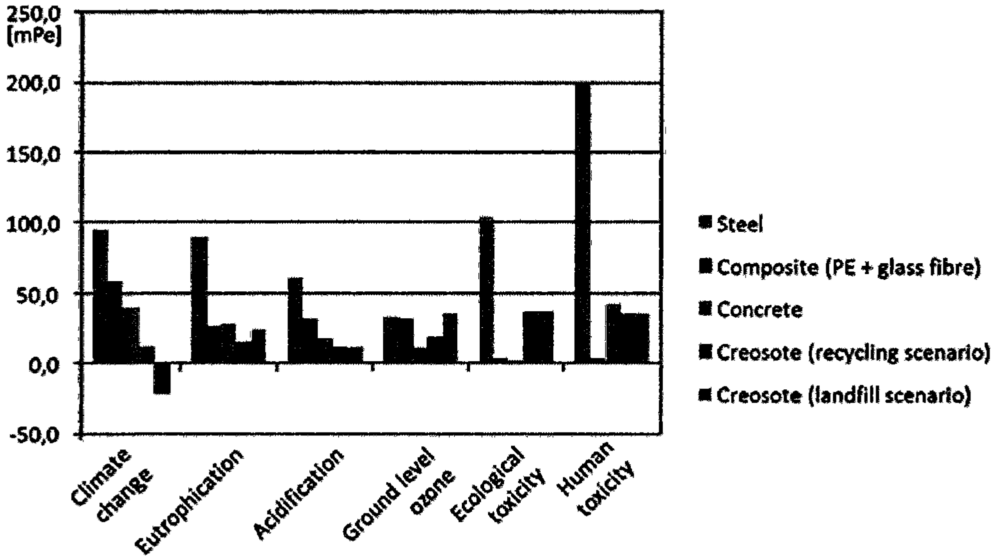
	1	preventive	wood rotting fungi discolouring fungi mould	2,3	superficial application
	4	preventive	wood rotting fungi discolouring fungi,	2, 3	superficial application
tebuconazole IPBC	1	preventive	wood rotting fungi discolouring fungi,	2, 3	superficial application
	1	preventive	wood rotting fungi	3	superficial application
propiconazole tebuconazole IPBC	1	preventive	wood rotting fungi blue stain	2, 3	Superficial application
	1	preventive	wood rotting fungi blue stain	2, 3	vacuum impregnation
propiconazole tebuconazole IPBC thiacloprid	1	preventive	woot rotting fungi insects	2,3	superficial application

Appendix V - Life Cycle Analyses (LCA:s)

I: Comparison of environmental impacts from utility poles of different materials – a life cycle analysis (Martin Erlandsson, Swedish Environmental Institute (IVL), 2011)

In this LCA a comparison was made between wooden poles treated with creosote, concrete poles, steel poles and composite poles (polyester-reinforced fiberglass with a polyethylene coating). The impact of each material on the environmental categories climate change, eutrophication, acidification, ground level ozone, ecotoxicity and human health was analysed and compared.

The results are given in Figure 4 from the LCA performed by IVL.



The results of this LCA shows that the most significant environmental aspect of all is emissions of metals from steel poles during the life cycle, which impacts ecotoxicity and human toxicity. The steel pole was also the pole which had the largest contribution to other environmental impact categories. Composite poles have generally similar environmental performance to concrete poles but concrete poles have greater impact on eutrophication while composite poles have greater impact on climate change. Creosote poles and concrete poles do not differ that much with regard to the aspects studied in the LCA. Concrete poles contribute more to climate change and eutrophication, while creosote treated wood has a higher impact on photochemical ozone formation, human and ecological toxicity.

The impact of concrete and steel are dependent on the level of hexavalent chromium in these materials. An assumption of a content of 5 % was made in this LCA. If the content is higher, then their impact will be worse. Concerning creosote, the impact of the creosote poles on human toxicity depends to great extent on the content of naphthalene in the creosote formulation. Other factors such as work environment and resource efficiency have not been addressed in this LCA.

II: LCA of an alternative concrete sleeper and a lineseed oil impregnated wooden sleeper as alternatives to creosote sleepers (Jan Schmidtbauer Crona, Studio CRONA AB & Melica 2012, currently available in Swedish only).

Trafikverket, the Swedish transport administration (railway) has made a survey over possible alternatives (Jan Schmidtbauer Crona, Studio CRONA AB & Melica 2012) summarised in the section of Life Cycle Analyses below.

In this LCA a comparison was made between the above mentioned sleeper types. The LCA was based on a previous investigation made by the same author summarising the current situation regarding possible alternatives regarding sleepers.

That study aimed at presenting the limited Swedish experiences of sleepers which can be used to replace individual creosote sleepers in track. In addition a number of potential, but up to this date not tested methods/materials, were presented. The study also includes a number of international, mainly American types of sleepers. The alternatives were described regarding their materials/method, function in track, environmental impact and cost. The study served a basis for decisions by Trafikverket (Swedish transport administration) regarding which potential alternatives should be getting more attention in the future as possible replacements for creosote sleepers.

Swedish experiences were presented for: Unimpregnated pine, unimpregnated oak, oiltreated pine sleepers with inlays of compressed wood, steel sleepers, and wood-plastic composite sleepers.

The following other methods/materials were presented: Linseed oil impregnation, furfurylation, acetylation, TCS- concrete with wood characteristics, and aluminium.

The following international sleeper examples/wood treatments were presented: Siberian larch, tropical hardwood, heat treatment, creosote sleepers with paraffine surface treatment/Italian method, metalsalt impregnation, TieTek-composite, Polywood-composite, Eslon FFU Neo Lumber composite, Primix Corporation – Dynamic Composites, Borate impregnation, PlasTies – wood with plastic cover, new creosote oil, and DMDHEU-treatment

The alternatives were prioritized according to their potential as a replacement sleeper for wood sleepers. Highest priorities were given to the following sleeper types: Linseed oil impregnation and TCS- concrete with wood characteristics. An LCA was then performed with these sleeper types as a basis. The main conclusions were: The standard concrete sleepers are not an option as single replacement of creosote sleepers as their characteristics differ from those of wooden sleepers. The assumed life spans were 50, 20 and 35 years for the TCS-sleeper, linseed oil sleeper and creosote sleeper, respectively. The results of the study show that the type of sleeper and sleeper usage have a high relevance for the Swedish environmental objectives Reduced Climate Impact and A Non-Toxic Environment. The term toxicity included both ecotoxic effects and health effects. The creosote sleeper has the lowest climate impact followed by the TCS-sleeper, while the lineseed oil sleeper has the highest impact. The TCS-sleeper has low toxicity in track but the stainless steel reinforcement has an impact on human health and a high impact on marine ecosystems from the production of the included materials in the production process. The effect of linseed oil sleepers is 2.6 and thirteen times higher on aquatic systems and soil, respectively than the corresponding impact of the creosote sleeper (WEI TypeB). The negative effects of the linseed oil origin from two biocidal substances[17] present in the oil. The linseed oil sleeper has further an uncertain life span essence, the LCA gives no coherent picture of which of the TCS or creosote sleeper types that has the least negative impact on the Swedish Environmental Objectives. It is, however, clearly indicated that the linseed oil sleeper in general has the most negative impact in relation to the relevant studied Environmental Objectives.

III: LCA of railway sleepers – Comparison of railway sleepers made from concrete, steel, beech wood and oak wood. (Frank Werner, Umwelt & Entwicklung, 2008).

The general conclusions from this LCA is that wooden sleepers treated with creosote had a lower impact in most environmental categories (photosmog, terrestrial, freshwater and marine ecotoxicity, human toxicity, stratospheric ozone depletion, acidification, depletion of abiotic resources and climate change). The single exception was eutrophication where all sleeper types were comparable.

IV: Life Cycle Assessment of Creosote-Treated Wooden Railroad Crossties in the US with Comparisons to Concrete and Plastic Composite Railroad Crossties (Bolin et al. 2013).

In this LCA comparisons have been made between creosote-treated wooden sleepers, concrete sleepers and plastic composite (P/C) sleepers. The assumed service lives were 35, 40 and 40 years for creosote, concrete and P/C sleepers, respectively. The environmental categories include greenhouse gases, fossil fuel use, acidification, water use, smog, eutrophication and ecotoxicity. The main conclusions were that creosote sleepers had lower impact on fossil fuel and water use and lower environmental impact than the concrete and P/C sleepers except for the category eutrophication. The life cycle of creosote sleepers results in lower release of net greenhouse gases (GHG) and lower ecotoxicity impact indicators. Reuse of wood sleepers for energy improves the environmental life cycle performance further.

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17 [redacted]