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Soudal N.V.
Everdongenlaan 18 -20
B – 2300 Turnhout
Belgium

Comments to the proposal to list "Chlorinated paraffins with carbon chain lengths in the range $C_{14\text{-}17}$ and chlorination levels ≥ 45% chlorine by weight" in Annex A, B or C to the Stockholm Convention on Persistent Organic Pollutants.

Chemical name: Alkanes, C14-17, chloro

Other IUPAC name: MCCP medium chain (C 14-17) chlorinated paraffin

CAS number: 85535-85-9

EC number: 287-477-0

Deadline for providing input: March 15^{th}, 2021

Background:

The UK is party to the Stockholm Convention on POPs, which are substances that persist in the environment, accumulate in living organisms and pose a risk to our health and the environment. DEFRA, the UK lead agency for the Stockholm Convention, is considering submitting a proposal to list chlorinated paraffins with carbon chain lengths in the range C14-17 and chlorination levels ≥45% chlorine by weight to the Stockholm Convention this year.

In accordance with Article 15 of the UK POPs regulation the Secretary of State for Environment, Food and Rural Affairs must publish a notice relating to the proposal and invite interested parties to submit comments about the notice within 8 weeks.

This document provides information to critique the proposal for listing.

Information on end use

Product applications

Medium chain (C 14-17) chlorinated paraffins, hereinafter referred to as MCCPs, are used in several applications. The main uses of Soudal and its affiliates of MCCPs are as plasticizers and flame retardants in moisture-cure, one-component polyurethane foams ("OCF") and in polysulfide-based insulating glass ("IG") sealants. Its great efficacy and cost-effectiveness make MCCPs a very essential product for these applications.

Challenges of greenhouse gas reduction and care for a sustainable environment are supported by our high-quality insulating foams and insulating glass sealants. OCF and IG are significantly contributing to fuel savings and reduction of energy consumption. In order to meet these challenges, these products have to meet various requirements such as high efficiency, ease of handling, safety, strong adhesion, elasticity, moisture vapour transmission rates and durability. MCCPs strongly contribute to the success of today's energy-saving construction products. The properties of MCCPs help meeting the customer technical and economic expectations regarding these products.

OCF and IG sealants have a very long life expectancy, more than 30 years. An important condition for this is a proper insulation or seal without being directly exposed to the outside environment such as UV from sunlight and rain. This way these MCCP-containing products will never be exposed to the environment. OCF always needs to be covered since they are not UV-resistant.

During application the foam is extruded from the can. After curing, MCCPs are embedded in the structure and have no tendency to migrate.

Amount of MCCP

The typical amount of MCCPs used in OCF is around 30%. The chlorination range of MCCPs in OCFs needs to be above 40% in order to obtain a good cell structure, and in that way creating an optimal insulation. IG sealants contain between 10 and 22% of MCCP, with a chlorination level of at least 50%.

The annual consumption of MCCPs is presented below in Table 1 for Soudal Belgium and its affiliates in Poland, Slovenia and Latvia. In one year, more than 6500 tons of MCCP is used to produce these energy-saving construction products. Our products are exported worldwide.

Table 1: yearly consumption of MCCPs in OCF and IG sealants at Soudal and affiliates

Affiliate	Sum of 2019 (KG)
Poland	1.850.000
Slovenia	750.000
Belgium	2.850.000
Latvia	1.050.000
Grand Total	**6.500.000 KG**

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Information on manufacture and supply chain

OCF

The manufacturing process of OCF, containing MCCPs, is carried out in a predominantly closed system.

MCCP arrives in bulk and is stored in large closed storage tanks. This is done via a special chemical unloading dock with provisions to collect potential spillage. The tanker is unloaded via a flexible line and pump. The volume in the tank is controlled via level measurement, which ensures overfill security.

Next, MCCP present in the large tank is dosed into a blending vessel via a pump and dosing valves. In these blending vessels, MCCPs are mixed with polyols. This polyol blend, containing MCCPs, is transferred via designated pipes into a buffer tank. From this buffer tank the mixture is pumped to the filling line into a can via a direct connection.

The whole system, starting from transfer of MCCPs in the large tank to the filling line is a closed system where spillages never occur. Furthermore, leftovers of the polyol blend which are still present in the pipes after dosing, will be reused next time. This way waste is non-existing in the production facility. Thanks to this closed process, cleaning steps are not required and the raw materials do not come into contact with the environment.

This unloading and dosing process is controlled by PLCs to avoid mistakes and unnecessary waste.

In the storage, filling and mixing areas there is no process water since contact with water should be avoided at all times. Emissions to water during the formulation process are zero.

IG sealants

MCCPs are delivered in bulk in a closed truck container and transferred into metallic silos. Next, they are transferred via pipes to a mixing vessel, where they are mixed with fillers, polymers and additives. This mixture is dosed into 200L drums. This is a fully automated and closed system. There is no waste generated in this process since cleaning and washing steps are avoided this way.

During the production process of these mixtures containing MCCPs, the chance of exposure to the environment is non-existent. The blending and formulation processes are designed to minimize any potential for environmental releases of the compounds. In case the final product is rejected, the off-spec product is handled as hazardous waste as required by applicable regulations.

Further, IG sealants are only used in industrial applications whereby a highly automatic sealing robot ensures contact with the environment is minimized and no spillages occur.

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Information on exposure and environmental release

OCF is used in a variety of applications in the building and construction sectors, for example to fill gaps in building walls. OCF contributes significantly in heat gain of the building. This is an important factor for overall building energy efficiency. IG sealants are contributing to reduction of energy waste by sealing the IG units and providing an excellent structural integrity.

After application, these products are always covered by for example doorframes, window frames or plaster. They are used exclusively on the inner shell of buildings and contact with the outside environment will not take place. Not being directly exposed to the outside environment as well as not migrating out of the structure ensures that emissions of MCCPs are minimized.

Further, it is important to note that water should be avoided at all times during the production process of OCF. This is due to the high reactivity of water with isocyanates used in the OCF product formulations, so there is no exposure of MCCP to water. Since no part of the formulation process is in contact with water, it does not present potential for environmental exposures.

Soudal and its affiliates invest significantly in safe technology, both in terms of emissions and raw materials used. This is one of the main policies. Consequently, the safety measures resulting from the risk analysis of a substance are strictly applied.

As required by article 14 of the REACH regulation a risk assessment and subsequent risk characterization is performed. Table 2 gives a summary of the environmental risk characterization of MCCP for formulation of adhesives and sealants, resulting from the risk assessment.

Table 2: Exposure Scenario: Adhesives and Sealants (Plasticizer / Flame retardants): Formulation, Industrial and Professional Use

Adhesives and sealants (plasticizer/ flame retardants): formulation, industrial and professional use		
Sector of use	Formulation	SU0
	Industrial Use	SU0
	Professional Use	SU22
Environmental release categories	Formulation	ERC2
	Industrial Use	ERC5
	Professional Use	ERC8f (Outdoor use) ERC8c (Indoor Use)
Control of environmental exposure		
Contributing scenarios	ERC2 Formulation of preparations	
	ERC5 Industrial use resulting in inclusion into or onto a matrix	
	ERC8f Wide dispersive outdoor use resulting in inclusion into or onto a matrix	
	ERC8c Wide dispersive indoor use resulting in inclusion into or onto a matrix	
Characteristics	Formulated into viscous liquid polymer matrix	
	Cures during use	
	Low volatility (nominal vapour pressure of $2.7x\ 10^{-4}$ Pa at 20°C)	
Organisational measures to prevent/limit release from site		
Closed sinks/ basins to prevent discharge to waste- and/or surface water.		
General good hygiene and housekeeping.		
Exposure estimation		
Used EUSES model [EE1]		
Protection target	**Exposure estimation**	**Risk characterisation ratio**
Fresh water (pelagic) (mg/L)	3.77E-05	0.038
Fresh water (Sedimentation) (mg/kg wet wt)	0.483	0.097
Sea water (pelagic) (mg/L)	5.04E-06	0.025
Sea water (Sedimentation) (mg/kg wet wt)	0.065	0.065
Soil (mg/kg wet wt)	0.079	0.0075
Concentration in fish for secondary poisoning (mg/kg wet wt); RCR for fish-eating birds and mammals	0.205	0.0205
Concentration in earthworm for secondary poisoning (mg/kg wet wt); RCR for worm eating birds and mammals	0.088	0.009
STP micro-organisms (mg/L)	2,00E-10	2,00E-08

The environmental risk assessment of MCCP shows that the risk characterisation ratios are very low. The values are far from the limit value 1, which makes the difference between risk or not. The outcome of the environmental risk assessment for formulation of adhesives and sealants with MCCP concludes that there is no environmental risk when using MCCP as a plasticizer or flame retardant in formulation, professional or industrial use of adhesives and sealants.

Production, handling and use of MCCPs are very well controlled and emissions to the environment are minimized. This risk assessment demonstrates adequate control of risks from the use applied.

During use by consumers, the contents of a OCF can or canister are dispelled under pressure as a viscous foam gel that solidifies by reacting quickly with moisture in the atmosphere to form a chemically and physically stable and rigid polymer foam product. The curing times for OCF is typically within minutes of use for the initial cure and then several hours for the final cure (fully cross-linked solid). Higher atmospheric humidity can result in faster cure times. MCCP is captured in the formed structure.

These minimized emissions to the environment are further supported by the FEICA Fact Sheet on the classification and labelling of one-component moisture curing polyurethane foams containing MCCPs.

The European producers of OCF, participating in the "FEICA OCF Working Group", instructed BMG Engineering AG (Zürich), an independent Swiss Institute, and NOACK Laboratories (Sarstedt), an independent German Institute, to execute suitable tests in order to investigate the influence of MCCP (in a typical one-component PU foam formulation) on the acute and chronic aquatic ecotoxicity of the product.

The tests that were performed:

- a 48-hour Acute Toxicity to Daphnia magna
- a fresh water algal growth inhibition test with Desmodesmus subspicatus
- a 28-day leaching test in aqueous media on the relevant limit concentration for chronic effects (1mg/l)

The tests were carried out with a generic one-component PU foam formulation, containing 30 % of MCCP (in the prepolymer) with a chlorine content around 45% by weight.

The test reports showed no negative acute effects on the Daphnia magna and algal growth, even for freshly sprayed one-component PU foam containing 30% of MCCP (+/- 45% Cl by weight) in the prepolymer. Thus, the results imply that acute labelling with H400 under CLP of one-component PU foam formulations containing up to 30 % MCCP, with around 45% chlorine by weight, in the prepolymer is not necessary.

The measured concentrations of MCCP in the leaching test were below the NOEC of 10 µq/L (Lowest NOEC for MCCP for aquatic invertebrates and the corresponding PNEC of 1 µg/L (freshwater)). In addition, it should be taken into account that this leaching study represents an extreme worst-case simulation of foam into contact with water since it is understood that (hydrophobic) MCCP will not be able to diffuse into water once the skin has formed and even less so when the foam is totally cured as MCCP is captured in the formed structure. In order to enhance the leaching potential of this structure, the foam was deep-frozen and milled to a powder prior to exposure to water.

Further, both the final substance evaluation report and the earlier Echa testing decision note that less chlorinated paraffins (40-<50% Cl by weight) are biodegradable and thus not persistent (i.e. not PBT or vPvB). The potential for biodegradation appears to increase with decreasing chlorine content, which implies that low chlorinated MCCPs are less persistent than products with high chlorine content. Lower chlorine content MCCP products (+/- 45% Cl by weight) might not be persistent within the meaning of the Annex XIII criteria. This must be considered.

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Possibility for substitution

Currently there are no technically and economically feasible alternatives available for our products with the same function and similar level of performance.

Suppliers of MCCP are not ready to substitute, as a result, downstream users also experience the consequences. The availability of equivalent alternatives is a big issue.

Current alternatives in OCF:

- **Tris(2-chloro-1-methylethyl)phosphate (TCPP):**
  - Risk assessment under development by the Member State Denmark: carcinogenic, mutagenic and toxic for reproduction are possible concerns.
  - Causes reduction in stability of the foam.
  - Very expensive (see socio-economic impact).
  - Availability issues.

- **Long chain chlorinated paraffins (LCCP):**
  - Still under development to use as alternative in OCF, but currently this alternative creates poor foam properties.
  - Very expensive (see socio-economic impact).
  - Viscosity problems: LCCP is very viscous (1800 mPa.s), in order to use in foam, the viscosity must be lowered, so TCPP, a viscosity reducer, must be added.
  - LCCP is more hydrophobic compared to MCCP, consequence: very poor cell structure.

- **Triethyl phosphate (TEP):**
  - Tested in OCF with poor end results, specifically foam shrinkage. The stability of the foam is very low.
  - Very expensive (see socio-economic impact).
  - The supply does not cover the demand.
  - A certain level is needed for the foam to comply with certain fire properties, however when this level of TEP is added, it will reduce the viscosity of the foam. The foam becomes too weak and cannot be used as insulation application.
  - Toxic byproducts in production process.

- **Confidential alternative:**
  - Not REACH registered yet: the supply does not cover the demand.
  - Current supplier is still adapting its production process, so no reliable samples to develop with or test.
  - The performed tests show that the product needs extra stabilization. When used as an alternative, the stability of the foam decreases.
  - A lot of research and development is needed to ensure sustainability.
  - Long term alternative.

Generally, chlorine is necessary to prevent the foam from being too hydrophobic. After all, it is very important that moisture is attracted so that curing can take place.

<u>Current alternatives in IG sealants:</u>

- **DINP**
  - More expensive.
  - DINP is not compatible with polysulfide sealants due to phase separation.

- **Long chain chlorinated paraffins (LCCP) (Cl > 50% [1]):**
  - More expensive.
  - Viscosity problems: viscosity of the sealant is too high.

- **Dibenzoate plasticizers:**
  - Very expensive.
  - Still under development.
  - Low hydrophobicity which results in a higher moisture vapour transmission rate which is not preferable for insulating glass durability.

MCCP is a critical chemical component in these formulations. MCCP is used to deliver key performances (e.g., adhesion and durability) and meet regulatory requirements, such as building fire safety codes. Eliminating or replacing MCCP from product formulations would require extensive research and development without any guarantees of success.

[1] IG sealants need a chlorination level of at least 50% to prevent migration out of the sealant.

Socio-economic impacts

Besides the technical advantages, MCCP also has an economic advantage in comparison with the alternatives. Below a comparison is made between MCCP and the substitutes.

Price per KG

MCCP: € 0.7 / KG

- **Tris(2-chloro-1-methylethyl)phosphate (TCPP):**
  - € 1.6 / KG (price increased to € 2.2 / KG to recent shortage)
  - This is an increase of 129% in comparison with MCCP.

- **Long chain chlorinated paraffins (LCCP):**
  - € 1.1 / KG
  - This is an increase of 57% in comparison with MCCP.

- **Triethyl phosphate (TEP):**
  - € 2 / KG
  - This is an increase of 186% in comparison with MCCP.

- **DINP:**
  - € 1 / KG
  - This is an increase of 43 % in comparison with MCCP.

Two scenarios have been developed to show the economic impact. In these scenarios the most recent raw material prices were taken into account.

- Scenario 1: A restriction in place on the use of MCCPs with chlorination level of >50%.
  - ⇨ The total current formulation cost will be increased with at least € 900 000.

- Scenario 2: A restriction in place on the use of all MCCPs:
  - ⇨ The total current formulation cost will be increased with at least € 18 000 000.

In reality these amounts will be higher due to development costs and increasing raw material prices by reason of supply-demand/availability issues.

Furthermore, since our products are exported worldwide, there is a lot of competition from non-EU countries, where there is no issue on using MCCPs. This creates unfair competition.

The specific technical and financial challenges faced with alternatives should not be underestimated. One of the main tasks of development is securing certain properties of our products. Besides the quality, higher costs are important obstacles to a transition to alternatives.