17 December 2010

Background document for Tris (2-chloroethyl) phosphate (TCEP)

Document developed in the context of ECHA's second Recommendation for the inclusion of substances in Annex XIV

1. Identity of the substance

Chemical name:	Tris (2-chloroethyl) phosphate
EC Number:	204-118-5
CAS Number:	115-96-8
IUPAC Name:	Tris (2-chloroethyl) phosphate

2. Background information

2.1. Intrinsic properties

Tris (2-chloroethyl) phosphate was identified as a Substance of Very High Concern (SVHC) according to Article 57(c) as it is classified according to Annex VI, part 3, Table 3.2 of Regulation (EC) No 1272/2008 as toxic to reproduction category 2, R60 (may impair fertility)[1], and was therefore included in the candidate list for authorisation on 13 January 2010, following ECHA's decision ED/68/2009.

2.2. Imports, exports, manufacture and uses

2.2.1. Volume(s), imports/exports

TCEP was manufactured in 1998 in EU15 in quantities of about 2000 t/y (EC 2009). Information given by industry in 2003 revealed that there has been no manufacture in Western Europe (EU15[2]) since 2001/2002. For 2005 (EU 25[3]), one site with an annual manufacturing volume of 300-500 t and export of similar amounts (300-400 t/y) have been reported (EC 2009).

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1 This corresponds to a classification as toxic to reproduction 1B, H 360F (may damage fertility.) in Annex VI, part 3, Table 3.1 of Regulation (EC) No 1272/2008 (List of harmonised classification and labelling of hazardous substances).

2 Referring to countries of the European Union before enlargement at 1st May 2004.

3 Referring to countries of the European Union after enlargement at 1st May 2004

For 2002 EU-wide use was estimated to be 1007 t/y, based on import/manufacture of 1.150 t TCEP and export of 143 t (Annex XV report 2009).

The occurrence of TCEP as a reaction by-product in the manufacture of other commercial flame retardants in which TCEP is present as impurity (tris(2-chloro-1-methylethyl)phosphate (TCPP); tris[2-chloro-1-(chloromethyl)ethyl]phosphate (TDCP); 2,2-bis(chloromethyl)trimethylenebis(bis(2-hloroethyl)phosphate)]) will not further been taken into account, as no specific reference has been made in the Annex XV dossier prepared.

In conclusion and in accordance with the estimation in the EU RAR (2009), the manufacture volume of TCEP in EU27 is around 400 t/y. Due to import and some export the total use in the EU is assumed to be around 1000 tonnes per year.

2.2.2. Manufacture and uses

2.2.2.1. Manufacture and releases from manufacture

According to in formation in the Annex XV report (Austria 2009) all commercial TCEP is manufactured by the reaction of phosphorus oxychloride with ethylene oxide. This is followed by subsequent purification and removal of the catalyst with aqueous-acid or aqueous-alkaline solutions and subsequently with water.

No measured information on releases from manufacture is available. EC (2009) estimated a local concentration in water resulting from 1000 t/y production of about 29 μg/l.

2.2.2.2. Uses and releases from uses

TCEP is mainly used as an additive plasticiser and viscosity regulator with flame-retarding properties for foams, polyesters and other polymers (e.g. polyurethane, polyvinyl chloride and polyisocyanurate). It is used in plastics, textiles (e.g. cushions, mattresses, carpet backing), adhesives, building insulation, coatings, paints and varnishes (EU RAR 2009, RCOM 2010). The main branches using TCEP are textiles, furniture and construction, as well as cars, railways and aircrafts (EC 2009, Reemtsma et al. 2008).

Even though recent information on uses could not be obtained, in 2004 TCEP was still used in paints in Europe (EC 2009), however it was assumed that these paints were intended only for professional use, not for consumers.

About 5 % of TCEP is used as intermediate in the chemical industry to manufacture wax additives (Austria 2009), that use is therefore not within the scope of authorisation.

Table 1: Estimated percentages and tonnages of TCEP in main uses (Annex XV report 2009)

	total tonnage in application
polymers	94 % (947 t/y)
intermediate	5 % (50 t/y)
paints	1 % (10 t/y)

The SPIN (Substances in Preparations In the Nordic countries) database reveals for 2006/2007 a tonnage of about 400 t in around 10 preparations, indicating some of the uses identified earlier (e.g. plastics, motor vehicles, construction). These are likely to be overestimates due to the way of presentation of the data in the SPIN database (Austria 2009); however it shows that TCEP is still used, even in consumer preparations (indicated for NO).

When used as plastic additives, migration to the surface and release into the environment by volatilisation, abrasion and dissolution can occur, as these ingredients are not chemically bound to the polymer matrix (Regnery & Püttmann 2010). Releases might be expected during service life and disposal of products containing TCEP (EC 2009). Particularly due to its high water solubility, TCEP easily migrates out of articles (e.g. toys) when sucking takes place (RCOM 2009, Danish Ministry of environment 2006). Due to its physicochemical properties, TCEP can be classified as semi-volatile organic compound with water being the preferred environmental compartment of distribution (Regnery & Püttmann 2010).

In the Risk Assessment Report (EC 2009) a total release to waste water treatment plants, surface water and atmosphere relevant for Authorisation under REACH (excluding intermediate use) has been estimated to be 1.8 t/y, 7.7 t/y and 1.0 t/y respectively.

TCEP belongs to the so called emerging pollutants and is found in water systems, as well as house dust all over the world. There is no significant removal of TCEP in waste water treatment plants resulting in surface water concentrations of few hundred ng/L (Reemtsma et al. 2008). In their study conducted 2007-2009, Regnery & Püttmann (2010) found in an urban (Frankfurt M.) and a rural area (Kleiner Feldberg) TCEP mean concentrations of 71 ng/L (max. 485 ng/L). Regarding indoor air, several studies (conducted between 1997 and 2005 with more than hundred samples) showed an average of 52 ng/m^3 and maximum values of >> 150 ng/m^3 (Reemtsma et al. 2008). The highest values are generally measured in office areas (Destaillats et al. 2008). Even though below the concentration limit established by the German Federal Environmental Agency of 5 µg/ m^3 (Möller 2003), it clearly shows significant releases of TCEP from widespread used articles. TCEP was further reported in settled indoor dust with a mean of 5.3 µg/g (< 0.1-121 µg/g) and in outdoor urban dust up to 5 µg/g (Reemtsma et al. 2008).

Xianghao et al. (2008) found reduced DNA synthesis in rabbit cells at concentrations as low as 10 µg/l. Further publications have been mentioned in the Annex XV report (2009) and during the commenting period (RCOM 2009) and show similar levels of environmental concentrations all over Europe and beyond.

2.2.2.3. Geographical distribution and conclusions in terms of (organisation and communication in) supply chains

No direct information on the structure of the supply chain could be found.

2.3. Availability of information on alternatives[4]

According to Sagunski et al (1997) and SCHER (SCHER, TCPP 2007) the use of TCEP is substituted by the alternative flame retardant Tris(2-chlorpropyl)phosphate (TCPP). EC (2009) reports information from industry stating that the replacement has been completed for all the applications for which replacement is possible.

A Risk Assessment Report for TCPP is available (EC 2008) indicating manufacturing volumes above 30,000 tonnes/year and these are increasing in recent years due to the substitution of TCEP and brominated flame retardants by TCPP. The TCPP Risk Assessment Report (EC 2009) concluded that there is the need for limiting the risks for workers.

2.4. Existing specific Community legislation relevant for possible exemption

No data available.

2.5. Any other relevant information (e.g. for priority setting)

No data available.

3. Conclusions and justification

3.1. Prioritisation

From the data available on manufacture, import and uses it is assumed that a high volume (≥ 1000 t/y) is supplied in the EU to uses within the scope of Authorisation. As TCEP is not bound to the polymer matrix and therefore can be released during service life and after disposal of products containing TCEP, many of its uses have to be considered wide-dispersive. Wide dispersive use is further confirmed by monitoring results of dust and water samples.

Verbal-argumentative approach

The volume used is high and there are releases to workers, environment and consumers from widespread used articles. Wide dispersive use is confirmed by monitoring results of dust and water samples.
On the basis of the prioritisation criteria the substance qualifies for prioritisation

[4] Please note that this information was not used for the prioritisation.

Scoring approach

Score			Total Score (= IP + V + WDU)
Inherent properties (IP)	Volume (V)	Uses - wide dispersiveness (WDU)	
0 (Reprotox, cat. 2)	7 (High volume)	Overall score: 3 * 3 = 9 Site-#: 3 (Use at more than 100 sites) Releases: 3 (diffuse/uncontrolled/significant worker exposure and environmental releases)	16

Conclusion, taking regulatory effectiveness considerations into account

On the basis of the prioritisation criteria the substance qualifies for prioritisation. No regulatory effectiveness considerations have been identified that would suggest to refrain from prioritisation.

Therefore, it is suggested to give tris(2-chloroethyl) phosphate priority and recommend it for inclusion in Annex XIV.

4. References

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