



**EVALUATION OF NEW SCIENTIFIC EVIDENCE
CONCERNING THE RESTRICTIONS CONTAINED IN
ANNEX XVII TO REGULATION (EC)
No 1907/2006 (REACH)**

**REVIEW OF NEW AVAILABLE INFORMATION FOR
dibutyl phthalate (DBP)**

**CAS No 84-74-2
EINECS No 201-557-4**

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REVIEW REPORT

JULY 2010

1. Introduction

Entries 51 and 52 of Annex XVII to REACH include the restrictions on the placing on the market and use of certain phthalates in toys and childcare articles, as initially introduced by [Directive 2005/84/EC of the European Parliament and of the Council of 14 December 2005](#). As explained in the recitals of this Directive, the six restricted phthalates were sorted into two groups associated with a different scope for the restriction. For DBP and the two other phthalates which are classified as reprotoxic, category 2 according to Council Directive 67/548/EEC¹ (i.e. DEHP² and BBP³) the restriction covers the placing on the market and use in any type of toys and childcare articles. For the three non-classified phthalates (i.e. DINP⁴, DIDP⁵ and DNOP⁶) the restriction covers the placing on the market and use in toys and childcare articles which can be placed in the mouth by children. In addition and as explicitly mentioned in entries 51 and 52 of Annex XVII, the Commission was to evaluate the restrictions concerning these six phthalates in the light of new scientific information by 16 January 2010, and if justified, these restrictions shall be modified accordingly.

The European Commission requested ECHA to review the available new scientific information for these phthalates and to evaluate whether there is evidence that would justify a re-examination of the existing restrictions.

According to the work plan agreed between ECHA and the European Commission, this document provides ECHA's report on its review of the new available information related to DBP.

The new available information related to DBP is rather limited, in particular if compared to other restricted phthalates like DEHP or DINP. Within the information submitted by stakeholders to the European Commission or ECHA, there is only few information available on the possible current uses of DBP in EU, and no study specifically dedicated to the exposure to DBP and potential related risks. It is nevertheless worth noticing that many new biomonitoring studies on phthalates in human body fluids as proxy to overall exposure are also reported, with a main focus on the presence of DBP and/or its metabolites in pregnant women or breast milk. The exposure at pre-natal stage appears indeed to be a potential human health concern. However, most of these reports do not bring enough conclusive information, in particular detailed exposure estimations, that could readily be used for updating the previous exposure and risk assessments. It has to be noted that, according to the agreed work plan, the information on hazard properties of DBP has not been reviewed at this stage.

¹ Council Directive 67/548/EEC of 27 June 1967 on the approximation of laws, regulations and administrative provisions relating to the classification, packaging and labelling of dangerous substances. According to the CLP Regulation (Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures) these three phthalates are classified as Toxic to Reproduction, category 1B.

² bis (2-ethylhexyl) phthalate; CAS No 117-81-7 / Einecs No 204-211-0

³ benzyl butyl phthalate; CAS No 85-68-7 / Einecs No 201-622-7

⁴ di-'isononyl' phthalate; CAS No 28553-12-0 and 68515-48-0 / Einecs No 249-079-5 and 271-090-9

⁵ di-'isodecyl' phthalate; CAS No 26761-40-0 and 68515-49-1 / Einecs No 247-977-1 and 271-091-4

⁶ di-n-octyl phthalate; CAS No 117-84-0 / Einecs No 204-214-7

2. Information on uses of the substance

Note: DBP is a phase-in substance according to the definition 3(20) of the REACH Regulation. DBP being classified as category 1B reproductive toxicant according to Regulation (EC) 1272/2008 (CLP), it can reasonably be expected that one or more registration dossiers for DBP will be submitted to ECHA by 30 November 2010. These registration dossiers will include information of the uses of DBP, as well as most probably a Chemical Safety Report with information on the volumes relevant for each use.

To date, only registration dossiers as part of a joint submission for transported isolated intermediates have been submitted to ECHA.

Total use of DBP:

DBP is a specialist plasticiser⁷ often used in combination with other higher molecular weight phthalates. DBP can also be used as a gelling aid, as a solvent, as an antifoam agent or as a lubricant (ECHA, 2009c; www.dbp-facts.com). When used as a gelling additive, its main application is in combination with other plasticisers for nitrocellulose, cellulose ether, and polyacrylate and poly(vinyl)acetate dispersions in the adhesives industry. Its properties as lubricant are used in particular in textile manufacturing. DBP is also used in the coatings industry as a primary plasticiser-solvent for nitrocellulose lacquers (ECHA 2009c; www.dbp-facts.com).

Therefore, in addition to interior and outdoor polymer applications, DBP can be found in a wide range of end products such as advanced textile products, coating and primary packaging of medicinal products, military propelling charges, explosives, equipments for nuclear installations, catalysts for the production of polypropylene. When used as a solvent, it is in oil-soluble dyes, insecticides, peroxides and other organic compounds (ECHA, 2009c; RCOM, 2009; www.dbp-facts.com).

DBP is also used as analytical standard for test and measurement instruments and as reagent in the manufacture of medicinal products and active pharmaceutical substances (RCOM, 2009).

A recent publication by the Danish Environmental Protection Agency (Danish EPA) (Danish EPA, 2009) gives an overview of several previous surveys aiming at analysing the presence of DBP in different consumer products to which 2 year-old children may in particular be exposed. It confirms that in 2002, and in addition to the specific uses which are further described in the following sections of this document (i.e. toys and childcare articles, school supplies, other articles for children, medical devices, cosmetics), DBP was reported to be found in vinyl floorings, in concentrations up to 1.6%.

However, as a consequence of the harmonised classification and labelling of DBP (category 1B reproductive toxicant according to new CLP Regulation⁸) companies have moved to the use of alternatives substances for many applications, and in particular to non-phthalate alternative substances. It also appears that for some applications the plasticised PVC has been replaced with other materials (ECHA, 2009c). This can be illustrated by the fact that the total manufacturing of DBP at EU

⁷ it is worthwhile noticing that DBP when used as a plasticiser is not chemically bound in the matrix

⁸ Regulation (EC) No 1272/2008 on the classification, labelling and packaging of substances and mixtures

level decreased from 26,000 tonnes/year in EU-15 in 1998 to less than 10,000 in EU-25 in 2007 (ECHA, 2009c). With EU exports counting for ca. 2,000 tonnes/year, the net use of DBP in EU was estimated at ca. 8,000 tonnes/year in 2007.

Furthermore, as DBP is on the Candidate List and it may be included in Annex XIV of REACH, the overall trend of decreasing use of DBP which has been observed in the last years in EU will probably continue in the next years.

Use in toys and childcare articles:

The restrictions on the use of DBP in toys and childcare articles as introduced in REACH Annex XVII entry 51 should have led in EU to a halt in the selling of these DBP-containing articles as of 16 January 2007. However, there is no further available information on the compliance of producers and importers with this restriction and whether DBP is present in these categories of products as a result of non-compliance with the existing restriction.

The already mentioned survey and health assessment of the exposure of 2 year-old children to chemical substances in consumer products (Danish EPA, 2009) shows that over the period 2002-2006 DBP was found in plasticine and in certain other categories of toys (toys made of plastic foam like books, masks, floor jigsaws or swords; (bath) dolls; inflatable feeding bottles), as well as in baby changing mats/cushions; however, DBP was always found in these products in concentrations less than 0.1%. The report also indicates that DBP was reported in 2006 to have been detected in an eraser which was categorised as a toy (identified as “*scented toy (eraser)*”) rather than a school supply, and at a concentration of 0.35 %. Similarly, it has to be noted that in the framework of another study led for the Danish authorities the presence of DBP was also indirectly detected in the component of a toy bag⁹ (i.e. which can be categorised as a toy rather than a school supply) from which DBP had migrated at the level of traces to artificial sweat, but without any further investigations about the actual concentration of DBP in the tested product. In the same context, phthalate-containing PVC was also found in components of two¹⁰ other (children) bags which can be categorised as toys rather than school supplies, without however any further investigations on which specific phthalate(s) was(were) concerned (Force Technology, 2007).

In addition to a detailed screening of existing surveys, the recent Danish study (Danish EPA, 2009) reports on analyses performed on a series of products to which children are highly susceptible to be exposed¹¹. Among these products were identified some childcare articles like pacifiers (including their coverage), non-slip figures and (bath/shower) mats, diapers and bed linen, and soft toys¹². It appears that DBP was not found in any of the tested products which could be categorised as toys or childcare articles.

However, it seems that most of these observations were made before the entry into force of the obligation in the current restriction. In other words if concentrations of

⁹ note that this product was danger labelled for children under the age of 3

¹⁰ out of 6 products analysed for this category of toys

¹¹ for each category of product (i.e. jackets, mittens, rubber clogs, rubber boots, pacifiers (including their coverage), soap packaging, non slip figures and (bath/shower) mats, soft toys, diapers, bed linen) five (5) products were analysed

¹² note that the toys and childcare articles listed here are covered by the current restriction

greater than 0.1 % by mass of the plasticised material are today found on the market it is a question of non-compliance and would require enforcement action.

Use in school supplies:

The only information available on the possible use of DBP in school supplies comes from a survey conducted for the Danish EPA (Force Technology, 2007). It indicates that small amounts of DBP were directly found in a pencil case¹³, as well as in the component of a school bag¹⁴ and in an eraser. However, this report does not provide any further details about the actual concentrations of DBP in these products. Moreover, this report states that among all the school supplies which were analysed, mainly DEHP and DINP were found but no attempt was made to quantify the small content of other phthalates, such as DBP. As far as DBP is specifically concerned, it also indicates that “*DBP was only found in the sweat extract in a single¹⁵ of the examined products in low concentrations*”.

Use in articles for/in contact with children:

It is reported in the already mentioned recent Danish study that DBP was found in some (children) clothes and on printings on shirts, but always in very low concentrations (i.e. lower than 0.1%). DBP was also detected in body stockings, but no concentration estimation was provided. Finally, DBP appears to have also been detected in swimming boards, both also in very low concentrations (Danish EPA, 2009).

As already mentioned in a previous section, in addition to a detailed screening of the existing surveys, a series of non-toy products to which children are nevertheless highly susceptible to be exposed, such as outdoor clothes (jackets and mittens), footwear (rubber clogs and rubber boots), and bath soap packaging, were also specifically analysed¹⁶. It appears that DBP was only found in two jackets¹⁷ (in a loose reflector piece in concentration lower than 0.1%, and in a zipper strap (concentration not known)) and in a pair of rubber clogs in a concentration of 2.6% (Danish EPA, 2009).

Use in medical devices:

In the framework of this review, no new information on the possible use of BBP in medical devices was made available by stakeholders.

¹³ note that this product was danger labelled for children under 3 years

¹⁴ note that this product was labelled « *Not for children under 3* »

¹⁵ it can be assumed that, given the uncertainties of the testing methods, only one measurement could finally be taken into account in the conclusions

¹⁶ for each category of product (i.e. jackets, mittens, rubber clogs, rubber boots, pacifiers (including their coverage), soap packaging, non slip figures and (bath/shower) mats, soft toys, diapers, bed linen) five (5) products were analysed

¹⁷ it has to be noted that no quantitative analysis of the concentration of DEHP in zipper straps was performed in the framework of this survey

Use in cosmetic products:

According to Industry, DBP is added in some countries to personal care products in order to impart qualities of durability and smoothness, or to improve their performance. In particular it appears that a small amount of DBP added to nail polish will improve the “*chip resistance*” properties of the final product (www.dbp-facts.com). A scientific article submitted to the European Commission in the framework of this review confirms that, in the US, DBP can be found in consumer and personal care products such as lotions, fragrances, cosmetics and deodorants (Marsee K *et al*, 2006).

However, it has to be noted that since 1 April 2005 cosmetic products containing DBP shall not be supplied to consumers in the EU, in accordance with Commission Directive 2004/93/EC of 21 September 2004 amending Council Directive 76/768/EEC concerning cosmetic products.

3. Information on exposure and related risk

Note: in their health assessment of the exposure of 2-year old children to chemical substances in consumer products¹⁸ (Danish EPA, 2009), the Danish authorities considered DBP as an anti-androgenic substance with regard to its effects on gamete development and development of mammary tissue in a development study in rats with a LOAEL of 2 mg/kg bw/day. This suggested LOAEL is considerably lower than the oral LOAEL of 52 mg/kg bw/day used in EU Risk Assessment Report (EU RAR) which was based on embryotoxic effects in a two-generation reproduction study.

In the rest of this document, calculations of margins of safety by comparison to the estimated exposures to DBP have been made for both of these two different LOAELs, when possible; however, in accordance with the agreed work plan for this review, the relevance to retain a different LOAEL than in the EU RAR is not discussed in this document, and conclusions are only drawn on the basis of the LOAEL in the EU RAR.

3.1. General population - Overall exposure

Several recent studies based on new biomonitoring data confirm the exposure of the general population to DBP, covering countries all over the world, including the EU. In these studies primary and secondary metabolites of DBP were indeed measured in several body fluids (urine, breast milk, saliva and serum) of different samples of the general population. Metabolites of DBP were for instance found in 64.5% of the breast milk samples from a total of 62 women in southern Italy (Latini G *et al*, 2009), as well as in Finnish and Danish cohorts' breast milk (Main KM *et al*, 2006). DBP metabolites were also reported in urinary samples of pregnant women in Israel (Berman T *et al*, 2008) and Mexico (Meeker JD *et al*, 2008). In Germany, the regular measurement of the concentration of DBP metabolites in urinary samples from adult subjects allowed to estimate the median daily intake of DBP of the general population at 7 µg/kg bw/day over the years 1988-1993, followed by a continuous decrease to 1.9 µg/kg bw/day in 2003 (Wittassek M *et al*, 2007). If compared to the oral LOAEL of 52 mg/kg bw/day selected in the EU RAR¹⁹, these estimations would lead to sufficient margins of safety (> 500) and would not indicate health concerns, even though it appears that 2% of the subjects were still presenting in 2003 higher daily intake in DBP than the Tolerable Daily Intake (TDI) deduced by the European Food Safety Authority (10 µg/kg bw/day) (Seekin E *et al*, 2009). Furthermore, on the basis of the results of a study led in 2005 in the United States in which the level of phthalates' metabolites in urinary samples of pregnant women were measured, it was estimated (modelling calculations) that the daily exposure to DBP of this sample of the general population was 2.68 µg/kg bw/day (95th percentile), with peak values up to 5.98 µg/kg bw/day (Marsee K. *et al*, 2006). Compared to the above mentioned

¹⁸ in the framework of this particular study, 17 specific substances (including DBP), considered as endocrine disrupters by the authors due to effects seen in animals studies, were selected. The risk assessment considered the possible exposure to these selected substances from 12 specific categories of products to which 2-year old children can reasonably be expected to be in contact with.

¹⁹ based on embryotoxic effects in a two-generation reproduction study

NOAEL, this would lead to a sufficient margin of safety (> 500). It was not possible to conclude in the framework of this review if these findings would still be applicable to the current situation within EU countries.

Finally, it has to be noted that information submitted to the European Commission in the framework of this review indicates that the use of DBP in enteric coatings (i.e. preventing release before it reaches the small intestine) of medicines (capsules) can potentially lead to exposures higher than the TDI deduced by the European Food Safety Authority (10 µg/kg bw/day) (Seckin E, 2009). In the example given, and assuming that 100% of the DBP is available, a capsule containing 3600 µg of DBP would indeed induce an exposure already exceeding the TDI and, if compared to the LOAEL used in the EU RAR (52 mg/kg bw/day), would lead to health concerns (i.e. margin of safety < 500) as soon as the patient weighs less than 35 kg. However, it was not further investigated in the context of this review whether the above assumptions are valid, and if health concerns can actually be raised in certain specific conditions of uses of DBP-containing medicines, for part or all the general population.

3.2. Occupational exposure

In the framework of this review, no new information on occupational exposure and related risks for workers was made available by stakeholders.

3.3. Children's exposure

In the following sections, an overview of the new available information, as well as a comparative analysis with the information contained in the EU RAR are given for the main categories of known contributors to the exposure of children to DBP, where possible, before the combined exposure is discussed.

a) Exposure and risks from toys and childcare articles

As already mentioned above, although restrictions on the use of DBP in toys and childcare articles as introduced in REACH, Annex XVII, entry 51 should have led in the EU to a halt in the selling of these DBP-containing articles as of 16 January 2007, there is no further information available on the compliance of producers and importers with this restriction, and whether DBP is still present in these categories of products as a result of non-compliance with the existing restriction.

From the available information, there is no new data and/or estimation of the remaining potential exposure and risks from toys and childcare articles which would be applicable to the sub-population of children as a whole. However, in their survey and health assessment of the exposure of the particular sub-group of 2-year old children (Danish EPA, 2009), the Danish authorities made an estimation of the possible exposures and risks from these categories of products. Firstly, there appear to be no migration values available for all the toys in which DBP was detected in the framework of the earlier surveys reported in the Danish study²⁰, including an eraser

²⁰ note that a maximum migration value of 6 mg of DBP/kg of product was nevertheless reported for plasticine; however this value was obtained by measuring the release of DBP in the indoor climate

which was categorised as a toy (identified as “*scented toy (eraser)*”) rather than a school supply and in which DBP was detected at a concentration of 0.35 % (i.e. the highest concentration reported for all the tested articles in these categories of products). Therefore no updated calculations of exposure and related risks were performed for that category of products. As far as childcare articles are concerned, it appears from a migration analysis performed on the only category of products in which DBP was detected in an earlier survey (baby changing mats/cushions) that only data concerning DINP was reported; the authors consequently assumed that there was no migration of DBP. Therefore, the potential contribution of these categories of products was not either taken into account in the overall risk assessment developed by the Danish authorities.

Hence, although it was not taken into account in the Danish update risk assessment for 2-year old children because of the absence of migration data, a remaining exposure to DBP from toys and childcare articles, in particular from the use of consumers articles which can be categorised as toys but are not necessarily identified as such (e.g. toy erasers), cannot be totally excluded. However, given the very low concentrations in which DBP was reported to be found in the tested toys and childcare articles, it can reasonably be assumed that the contribution of these categories of products to the overall burden of children in DBP is not significant and cannot as such raise human health concerns. This tends to confirm the assessment made within the framework of the EU RAR (EU, 2003).

b) Exposure and risks from the use in school supplies

There appears to be no new information on potential exposure to DBP and related risks from the use of school supplies by children. However, it appears from the available information (Force Technology, 2007, see “2. *Information on uses of the substance*”, section “*Use in school supplies*”) that DBP has always been found in low concentrations in this category of products. Therefore it can reasonably be assumed that their contribution to the overall burden of children in DBP is not significant and cannot as such raise human health concerns. Moreover, it has to be noted that in their updated health assessment of the exposure of the particular sub-group of 2-year old children to DBP (Danish EPA, 2009), the Danish authorities did not include the potential contribution of these products in their calculation of the overall exposure to DBP and related risks. Indeed, even though it is explicitly mentioned - in an introductory paragraph to the updated estimations of exposure from “other (consumer) objects” - that exposure to DBP could happen from erasers in the case of the presence of older siblings in the house, the Danish authorities only mentioned that no migration study was available for the only (toy) eraser (see previous section) in which DBP was found, and did not investigate further the potential contribution of these products to the overall burden of 2-year old children in DBP.

when plasticine was heated at 200°C, and it appears that it was not taken into account for the update of the exposure and risk assessment.

c) Exposure and risks from other sources

There appears to be no new available information related to exposures and risks from other sources of DBP, and more generally to overall exposures and risks, which would be applicable to the sub-population of children as a whole. However, in their new health risk assessment for the particular sub-group of 2-year old children (Danish EPA, 2009), the Danish authorities developed an updated estimation of the overall exposure to DBP, but also included updated estimations for the specific contributions of indoor climate (dust and air), food, toys and childcare articles, and other consumer products such clothes and rubber clogs. This section presents the results and conclusions of this study with regard to all the potential sources which have not been discussed otherwise in the previous specific sections of this document (i.e. toys and childcare articles, and school supplies). The estimation of the total combined exposure will then be discussed in the next section.

With regard to indoor climate (air and dust), the risk assessment developed by the Danish authorities estimates the daily ingestion of DBP (95th percentile) to be between 2.28 µg/kg bw/day²¹ and 4.08 µg/kg bw/day²², depending on whether a summer (50 mg of dust ingested on a daily basis) or a winter (100 mg of dust ingested on a daily basis) scenario is used; it is assumed that exposure to DBP from vinyl floorings is already included in these estimations. If compared to the oral LOAEL of 52 mg/kg bw/day used in the EU RAR, the associated margin of safety is ca. 10,800 or more. Therefore, even though an acceptable margin of safety should be higher than 100 in order to take into account the fact that a LOAEL is used rather than a NOAEL (an additional uncertainty factor of 5 is suggested in the EU RAR; the Danish study used a factor 3), it can be concluded that the exposure to DBP from indoor climate does not as such constitute a health risk for 2-year old children²³. The same conclusion would apply if, as suggested by the Danish authorities in their report, a new LOAEL of 2 mg/kg bw/day for anti-androgenic effects of DBP was used; however, in this case, the margin of safety (490) would approach its limit of acceptability.

For exposure to DBP from food, the updated exposure estimations suggest to retain a worst-case value of 22 µg/kg bw/day (from Wormuth *et al*, 2006 as cited in Danish EPA, 2009). If compared to the previous estimations in the EU RAR, it can be concluded that this updated estimation is higher but still in the same order of magnitude as the contribution of regional exposure (0.36 µg/kg bw/day) and the specific exposure from breast milk feeding (maximum of 6 µg/kg bw/day respectively) as were estimated in the EU RAR. It is also comparable to the estimated average intake of 0.23 mg DBP/day via diet (general population) in the EU RAR, leading to 28.75 µg/kg bw/day for an 8-kg infant, and 15.1 µg/kg bw/day for a

²¹ 50th percentile: 0.67 µg/kg bw/day

²² 50th percentile: 1.17 µg/kg bw/day

²³ it can also be noted that if the specific contribution of air (without dust) in the exposure to DBP via inhalation route is considered the Danish authorities report a maximum measured concentration of DBP in indoor air of 1.1 µg/m³; if compared to the inhalatory NOAEC of 509 mg/m³ used in the EU RAR, the margin of safety is very high (4.6·10⁵).

15.2-kg²⁴ child. These figures confirm that food is (one of) the major contributor(s) to the overall exposure of children to DBP. All these estimations would nevertheless lead to margins of safety of 18,000 or more if compared to the oral LOAEL of 52 mg/kg bw/day used in the EU RAR, and therefore to the confirmation that exposure to DBP from food does not raise health concerns as such; however, if compared to the new LOAEL of 2 mg/kg bw/day for anti-androgenic effects of DBP proposed by the Danish authorities, the margins of safety would then be systematically less than 132, potentially leading to different conclusions. It has also to be noted that 1.9 mg DBP/person/day was taken in the EU RAR as the worst-case value for the daily intake of DBP via food for the general population (consumers). If applied to a 15.2-kg child, this would lead to a maximum daily intake of 125 µg/kg bw/day²⁵, i.e. to a much higher daily intake of DBP via food and a margin of safety of only 416 if compared to the oral LOAEL of 52 mg/kg bw/day used in the EU RAR, and even 16 if compared to the new LOAEL of 2 mg/kg bw/day for anti-androgenic effects of DBP as proposed by the Danish authorities. Therefore, if applicable to children, these worst-case exposures could lead to the conclusion that food as such can be a significant source of exposure and raise health concerns for the children sub-population. However, there is no clear information available, neither from the EU RAR nor from the new available information, confirming that 1.9 mg DBP/person/day from food can also be used for children, and in particular whether the assumptions/measurements made for this estimation on the basis of adults' diet are also applicable to children.

As far as the other articles which were investigated in the framework of the Danish study are concerned, it first of all appeared from the screening of previous studies that no migration estimations were available for (children) clothes and printings on shirts, body stockings, and swimming boards. Therefore, no exposure and related risks estimations were performed and the potential contribution of these (categories of) products could not be included in the updated health risk assessment. However, a migration analysis was conducted on the zipper strap of one of the jackets which were specifically analysed in the framework of this study, and in which DBP had been detected; on the contrary, no migration analysis was conducted on the loose reflector of the other jacket from which DBP had also been detected (see "2. *Information on uses of the substance*", section "*Use in articles for/in contact with children*"). On the basis of a measured migration rate of 0.51 mg/kg (over a period of 3 hours) and a 3-hour daily sucking, the related exposure was estimated at 0.084 µg/kg bw/day, leading to a specific margin of safety of more than $6 \cdot 10^5$ if compared to the oral LOAEL of 52 mg/kg bw/day used in the EU RAR, and more than 23,000 if compared to the new LOAEL of 2 mg/kg bw/day for anti-androgenic effects of DBP as proposed by the Danish authorities. Therefore the exposure from that part of a jacket does not appear to raise health concerns. As for the pair of rubber clogs in which DBP was detected in the framework of this new study, a migration rate of 249 mg DBP/kg was found over a period of 6 hours. On the basis of an absorption rate via the dermal route of 10%²⁶, it was estimated that the use of rubber clogs could lead to a daily intake of DBP between 15.07 and 75.36 µg/kg bw/day, depending on the time the products are worn

²⁴ average weight used for a 2-year old child in the Danish study (Danish EPA, 2009)

²⁵ for a 8-kg infant : 237.5 µg/kg bw/day ; margins of safety : 219 for LOAEL of 52 mg/kg bw/day / 8.4 LOAEL of 2 mg/kg bw/day

²⁶ worst-case scenario selected in the EU RAR

(between 4 and 10 hours a day, if used both as outdoor shoes and slippers) and the actual fraction of the product in dermal contact (between 20 and 40 %, assuming as worst-case scenario that children do not wear socks). If confirmed, these estimations would show that rubber clogs can be, in certain circumstances, a major contributor to the total burden of children in DBP. If compared to the oral LOAEL of 52 mg/kg bw/day, these estimations would nevertheless lead to margins of safety of at least 690, which can be considered as acceptable as such, even though it shows that the remaining margin of safety for additional exposures from other sources, and in particular from food and indoor air, tends to be rather low (see next section on overall exposure and risks). If compared to the proposed LOAEL of 2 mg/kg bw/day for anti-androgenic effects of DBP, the margins of safety would be between 133 and 27, leading to unacceptable levels of risk from the use of rubber clogs by 2-year old children (under certain conditions) only.

d) Overall exposure and risks

There is no new estimation of the overall exposure to DBP and related risks available which would be applicable to the sub-population of children as a whole. The survey and health assessment of the exposure of 2 year-old children to chemical substances in consumer products (Danish EPA, 2009) gives nevertheless an updated estimation of the combined exposure to DBP of this particular sub-group of the general population which can be expected to give a general trend for children in general. On the basis of the specific exposure estimations as described in the previous paragraphs of this document, the maximum daily intake²⁷ for 2-year old children in DBP is estimated at 99.64 µg/kg bw/day in summer²⁸ and 26.16 µg/kg bw/day in winter²⁹. If compared to an oral LOAEL of 52 mg/kg bw/day, these total exposure estimations would lead to margins of safety of 522 and 1,988 for summer and winter scenarios respectively, and to the general conclusion that the actual total exposure of 2-year old children to DBP should not raise any health concerns. Such a conclusion could however be matter of discussion with regard to the estimated total exposure in the summer scenario which leads to a margin of safety already very close to the agreed acceptable limit (300 to 500) and leaves a very limited margin of safety for any additional exposures from sources which may not have been taken into account in this updated assessment. It has also to be noted that, with the proposed new LOAEL of 2 mg/kg bw/day for anti-androgenic effects of DBP, the corresponding margins of safety would be 20.1 and 76.5 for summer and winter scenarios respectively. On the other hand, it has to be noted that these updated combined exposure estimations have been calculated by adding all the available worst-case scenario values, and in particular for the two main contributors which are food (maximum value) and rubber clogs (worn 10 hours a day, without socks, and with 40% of the total product in contact with skin). In the EU RAR for DEHP³⁰, it is stated that “*it is generally difficult to quantitatively assess combined*

²⁷ including contributions from food, indoor climate, jackets' zipper straps and rubber clogs

²⁸ in summer scenario the potential contribution of jackets' zipper strap is not included (jacket being considered as winter clothes)

²⁹ in winter scenario the potential contribution of rubber clogs is not included even though it was estimated rubber clogs can also be used indoor as slippers

³⁰ it is assumed here that this general statement also applies to DBP

exposure, as addition of several reasonable worst-case values (e.g. 95th percentile exposure values) could lead to a rather unrealistic sum, because it is perhaps not that likely that an individual belongs to the 5% most highly exposed individuals for all different exposure routes/sources”.

Furthermore, in addition to updated substance-specific risk assessments for individual chemicals, the Danish report proposes cumulative Risk Characterisation Ratios for several substances which have been grouped as anti-androgenic substances by the Danish authorities, oestrogen like substances and substances that may have both effects. Different ratios have been calculated for winter and summer scenarios, taking into account the total chemical burden via the following routes³¹:

- ingestion of food,
- ingestion of dust (50 mg in summer / 100 mg in winter),
- dermal contact with toys (9 hours in summer / 6 hours in winter),
- contact with other objects than toys, i.e. moisturising cream, bath articles and other textiles than winter clothing,
- contact with sunscreen lotion (summer only),
- contact with rubber clogs (summer only),
- contact with jackets/mittens (winter only).

As already mentioned in this document, DBP has been considered by the Danish authorities as an anti-androgenic substance, with a proposed LOAEL of 2 mg/kg bw/day for its effects on gamete development and development of mammary tissue in a development study in rats, which is lower than the oral LOAEL of 52 mg/kg bw/day used in EU RAR which was based on embryotoxic effects in a two-generation reproduction study.

Moreover, it has to be mentioned that over the last years particular attention has been paid to prenatal exposure of foetuses and on exposure of neonates/infants, in particular via breast feeding, and certain recent studies which were submitted in the framework of this review mention that foetal exposure may be a route of exposure of higher concern than post-natal exposure (Wittassek M *et al*, 2009; Meeker JD *et al*, 2008). In particular, an abstract of a pilot study was submitted in the framework of this review, indicating that metabolites of DBP were detected in 11 pairs of amniotic fluid and suggesting that DBP and its metabolites can reach the human foetus. No conclusions in terms of exposure and potential health effects and risks were nevertheless made available (Wittassek M *et al*, 2009).

³¹ same as those considered in the substance specific assessments, e.g. for DBP

4. Conclusions and suggestions for further action

In conclusion, DBP appears to be used in lower total volumes than those reported when the EU RAR was agreed.

The available information does not show that the current uses of DBP would lead to major health concerns, including those which were not already identified in the EU RAR. The available information only shows that, in addition to the categories of products which were already investigated in the past, DBP can also be found in some limited categories of PVC-containing school supplies (erasers, bags, pencil cases), as well as in some other specific consumer products to which children may be exposed like elements of shirts or jackets and rubber clogs. However, this information is usually based on a relatively limited number of products tested, and the measured concentrations of DBP in these products appear to be very low (i.e. below 0.1%). Among these products, the highest concentration was indeed measured in a pair of rubber clogs, which was containing 2.6% w/w of DBP. Therefore, there is a need to be cautious in drawing definitive conclusions on the significance of these potential additional/new exposures. The available information also appears to confirm that the major remaining contributors of children's exposure to DBP are food, and, to a lower extend, indoor climate (air and dust). It has to be noted that the abstract of another study which was made available in the framework of this review also confirms that food has a major influence on the exposure to DBP of the general population, including children (Wormuth M *et al*, 2006).

From a risk assessment developed by the Danish authorities for the specific sub-group of 2-year old children it nevertheless appears that the use of the above mentioned rubber clogs might raise health concerns. However, it shows also that the level of exposure to DBP leading to health risks can be reached only in very specific and intensive conditions of use of these products. Therefore, in order to conclude whether there is actually a need for addressing these potential risks via new regulatory measures or not, further in-depth assessment would be needed, in particular to conclude on the appropriateness of the assumptions used in the Danish study. Furthermore, it is also not clear whether these conclusions can also be applied to other sub-groups of the children population.

ECHA considers that the available new information with regard to uses of and exposure to DBP does not bring a new perspective to the assessments which were carried out in the past and used as a basis for the current restrictions on DBP; no new risk assessment was submitted in the framework of this review which covers all potentially sensitive sub-populations (e.g. children) which were addressed in the EU RAR, ECHA considers that the new information which was made available in the framework of this review does not indicate the need for an urgent re-examination of the existing restriction on DBP.

Therefore, ECHA suggests to wait for the submission of the registration dossier(s) for DBP after which the Commission may decide whether specific aspects of these registration dossier(s) should be assessed to confirm or contest the conclusion of this review that there is no need to re-examine the current restriction. Furthermore, as DBP is already included in the Candidate List in accordance with Article 59 of the REACH Regulation, the notifications under Article 7(2) may bring further information on the presence of DBP in articles after June 2011. Moreover, in case DBP will be included in Annex XIV of REACH, the potential future applications for authorisation may further clarify the uses of DBP and possibilities to control their

related risks. In particular, the exposure of children via clothes and footwear (rubber clogs) may need to be further investigated in order to more precisely identify the main potential contributors to children's exposure to DBP via this route.

It has also to be noted that the general topic of cumulative and/or synergistic effects of exposure to several chemicals, and in particular to several phthalates or other substances suspected to have endocrine disrupting effects, regularly appears through the documents which were under the scope of this review (e.g. in Borch *et al.*, 2004; AFSSET, 2009; National Research Council, 2008, as cited in AFSSET, 2009; Ghisari & Bonefeld-Jorgensen, 2009; Tanida *et al.*, 2009; Lottrup *et al.*, 2006; Sharpe, 2008). It is suggested in some of these studies that, even though the exposure to individual phthalates may be not of concern for human health, except maybe for certain specific sub-populations, it cannot be excluded that the total exposure to all phthalates or to a phthalate together with other chemicals could raise health concerns, and this issue should therefore be further investigated. Furthermore, in its opinion of 6 February 2008 (SCENIHR, 2008), SCENIHR states that “*Combined exposure of different population and subpopulation is possible and may occur at different times or together. Due to the wide use of DEHP in society humans may be exposed from many different sources and exposed to other phthalates as well. It is obvious that combined exposure to DEHP, DBP, BBP, DIBP, and DINP having the same mechanism of action may potentially cause at least an additive effect. Combined exposure to DEHP and DINP had showed an additive effect (Borch et al. 2004)*”. The survey and health assessment of the exposure of 2 year-olds children to chemical substances in consumer products which was recently published by the Danish authorities (Danish EPA, 2009) also considers a cumulative risk assessment of potential endocrine-like substances, including DBP (as well as other phthalates DiBP, DEHP, BBP, and DINP). The assessment of the potential combined effect of exposure to different phthalates goes beyond the scope of this evaluation of new scientific evidence concerning the current restrictions on DBP. Moreover, in the context of the Council discussion on this subject³² the Commission has indicated that it will review the existing legislation in terms of its suitability to assess the effects of combined exposure.

³² information from the Danish delegation on “*Combination Effects of Chemicals – children exposed to multiple endocrine disrupters*” dealt under “other business” at the meeting of the Council (Environment) on 21 October 2009 (Doc. ref. 14420/09 ENV 674 CHIMIE 79)

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