Risk Assessment of Villa Zebra materials

Ir. P. Medici

Introduction

This risk assessment for human health is only based on hypothesis formulated from existing information and studies. In order to have a more detailed measurement about which toxic chemical compounds are released by some materials (Source) and how, through different path (Pathways), they can be absorbed by children (Targets), we would need a laboratory test.

PVC-pipes

The PVC itself is not toxic. But mostly some toxic plasticizers are added. Some of them could leak out from the PVC. Since 2006 the Directive 2005/84/EC prohibits the following PVC phthalates plasticizers in toys and childcare articles because of toxicity risk: bis (2-ethylhexyl) phthalate (hereinafter DEHP), dibutyl phthalate (hereinafter DBP), benzyl butyl phthalate (hereinafter BBP). In the same Directive, di-"isononyl" phthalate (hereinafter DINP), di-"isodecyl" phthalate (hereinafter DIDP), di-n-octyl phthalate (hereinafter DNOP) are banned in toys and childcare articles which can be placed in the mouth by children [1].

[1] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32005L0084:EN:HTML

Copper wires covered by PVC cables

PVC's cables always contain some additives in order to make PVC's flexible. Those additives can be phthalates; some of them may impair fertility and are suspected of damaging the unborn child [1] [2]. There are concerns about the fact that those additives could leach out from soft toys when children chewing on them. For these reasons, as written above, six types of phthalate softeners, including DEHP and DINP were banned for toys by EU in 2006 [3]. In the case that the additives in PVC cables were the phthalate softener banned in the directive, letting the children play with them, we would act in disregard with the law. That's because children would play with PVC tubes as they play with toys. Sometimes PVC contains other additives which may be also toxic. These are only hypothesis based on existing information, without having analyzed in laboratory the PVC cables. Anyways we know that phthalates are often used in electrical cables [4] [5] [6]. Moreover is known that the old PVC tubes available for Villa Zebra are from ELDRA, KEMA-KEUR type (see **Fig. 1**). This information is readable from the code written on it (see **Fig. 2**). On the product specification paper of ELDRA's PVC cables it is written that cables follow the International Standards Organization (hereinafter ISO) standard EN 50363-3 [7] [8]. In that ISO standard is not specified which additives should be added. At the same time there is not any restriction about the use of phthalates as additives. Considering existing information it is very probable that our PVC cables contain phthalates [9]. These phthalates can be from the group of the ones which are banned in toys and childcare articles like for instance

Fig. 1. Conceptual Model Risk Assessment

DEHP, or from the group of the ones which are banned in toys and childcare which can be placed in the mouth by children, like DINP.

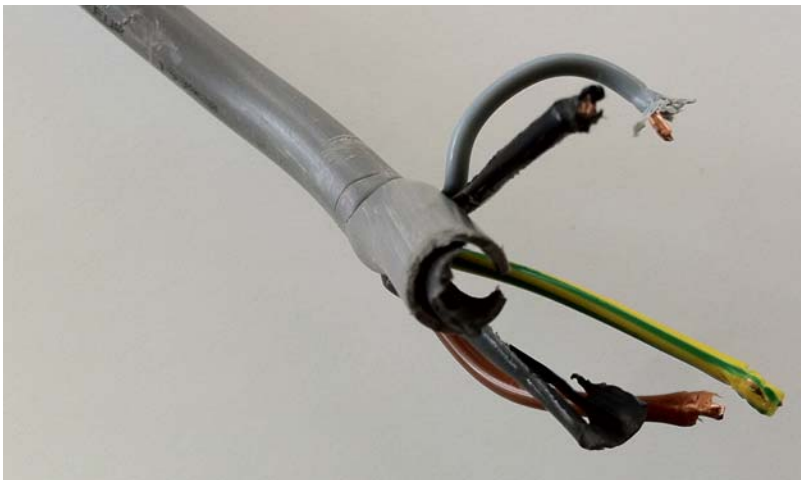

Fig. 2. PVC Cable

In order to know exactly which phthalates were used we should contact the manufacturer. If our cables contain phthalates from the first group, letting the children play with cables would means acting in disregard with the European Directive. Since cable are small enough to be placed in the mouth by children (a behavior which is more probable for children from 4 to 8 years old), we would be in disregard with the law even if in the cables there are only phthalates from second group. Even if we do not have the certainty about which additives are used to manufacture the cables, since alternatives are available the use for Villa Zebra workshop is not suggested as a precautionary principle. Human Health Risk assessment is defined as the interaction in between sources (S), pathways (P) and targets (T):

$$R=S \times P \times T$$

Following this it is possible to trace a conceptual model (see **Fig3**). If the Phthalates contained in the PVC cables are both from the first or the second group of the European Directive, they are able to reach the target from the source through the pathways. This would happen in the same way as for children playing with toys containing phthalates.

Fig. 3. Code written on the cable

Copper wires itself are not toxic. They can be quite sharp and they can cut. If ingested they can cut inside the human body.

[1] Sigma-Aldrich Company Ltd. (Revision Date 24.01.2011). Dioctyl phthalate. *Safety Data Sheet*.

[2] Sigma-Aldrich Company Ltd. (Revision Date 31.03.2011). Diisononyl phthalate. *Safety Data Sheet*.

[3] European Union, Commission Directive 2005/84/EC of 14 December 2005, amending for the 22nd time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (phthalates in toys and childcare articles).

[4] A.O. Earls, I.P. Axford, J.H. Braybrook (2003). Gas chromatography–mass spectrometry determination of the migration of phthalate plasticisers from polyvinyl chloride toys and childcare articles. *Journal of chromatography A*.

[5] Michael A. Babicha,*, Shing-Bong Chenb, Michael A. Greenec, Celestine T. Kissd, Warren K. Porterb, Timothy P. Smithd, Marilyn L. Winda, William W. Zamulae (2004). Risk assessment of oral exposure to diisononyl phthalate from children's products. *Regulatory Toxicology and Pharmacology*.

[6] Judith P. Amberg-Muller, Urs Hauri, Urs Schlegel, Christopher Hohl, Beat J. Bruschweiler (2010). Migration of phthalates from soft PVC packaging into shower and bath gels and assessment of consumer risk. *Journal of Consumer Protection and Food Safety*.

[7] ELDRA ELECTRO-DRAAD BV. Product specification 20301, Single core non-shealthed cables for internal wiringfor a conductor temperature of 90 C.

[8] NEN-EN 50363-3. Insulating, sheathing and covering materials for low voltage energy cables – Part 3: PVC insulating compounds (March 2006).

[9] http://www.plasticisers.org/

Compact Discs

They are composed by Polycarbonate and Aluminum sheet.
Mechanical dangers: May be dangerous (sharp, cutting) if broken.
Toxicity: Polycarbonate is produced using Bisphenol A (BPA). BPA (which is an endocrine disruptor, may lead to negative health effect) is banned by EU in Polycarbonate baby bottles by 1 March 2011. This is because some plastics may leak BPA. If broken, small parts of Polycarbonate, Aluminum can irritate eyes and if inhaled could irritate throat [1] [2] [3].
Advice: if an alternative is available try to avoid giving the CD's as a workshop material to children. They could be chewed, put in the mouth mostly if they are broken in small parts.

[1] http://www.bisphenol-a.org/pdf/DiscoveryandUseOctober2002.pdf

[2] http://health.usnews.com/health-news/family-health/heart/articles/2009/06/10/studies-report- more-harmful-effects-from-bpa

[3] http://www.niehs.nih.gov/news/media/questions/sya-bpa.cfm

CD's covers

About CD's covers, considering that, children will be not in direct contact with Polycarbonate (which can release Bisphenol A) but they will be in contact with covers which were containing Polycarbonate, the health risk should be negligible. Even if compact discs' covers might carry a small amount of BPA on their surface released from PC, this amount should be too small to be considered a risk.

Carpet tiles

If they are not manufactured by environmental friendly producers like DESSO (Cradle to Cradle Certified) or InterfaceFLOR (EPD certified), they may release VOC's (volatile organic compounds). Some studies say that if they are manufactured by standard companies and they have been used for more than seven years they no longer emit VOC's, poisonous vapors. The carpet we will use are from InterfaceFLOR. They obtained several environmental certifications (see Annexe 6). A full toxicity risk analysis has not be made yet since we don't even know exactly of which type of carpet the company will provide us and all the materials by the carpets are composed. So far we know that carpets contain Polypropylene and Nylon. Risk of toxicity for children playing with part of InrfaceFLOR should be very low.
On 15th April 2011 InterfaceFLOR updated us about the fact that all of their carpet meets the criteria of GUT, each product has its own certificate. The GUT test system is focused on emissions of volatile organic compounds and monitoring the use of chemicals [2].
InterfaceFLOR carpets then are certified to be not toxic for children playing on it. Then they should be not toxic even if children are playing with it.

[1] http://www.superuse.org/story.php?title=carpet-tile-tale

[2] http://www.pro-dis.info/wat-is-prodis.html?&L=2

Cardboard tubes

Cardboard from cardboard tubes should be safe. It only depend on which kind of carpet, foil was carried and where the cardboard tube was stored. This is because cardboard can easily absorb various substances.
Cardboard tubes available are provided by the company "van-Sprang", they were carrying self-adhesive vinyl banner. Those are textiles made by PVC. PVC may contain some phthalates softeners like DEHP (diethylhexyl phthalate). As we said phthalates are additives used to make PVC softer and more flexible. Phthalates like DEHP may impair fertility and are suspected of damaging the unborn child [2]. There are concern about the fact that additives like DEHP could leach out from soft toys when children chewing on them. For these reasons, six types of phthalate softeners, including DEHP, were banned for toys by EU in 2006 [1].
However considering that in Villa Zebra children will be not in direct contact with PVC but they will be in contact with cardboard tubes which were just carrying PVC, the health risk for kids

should be negligible. Even if cardboard tubes might absorb a certain amount of Phtalate from PVC, this amount should be too small to be considered as a risk.

[1] See directive 2005/84/EC

[2] See directive 67/548/EEC

Fluffy Animals

Normally are not toxic. It depends where they were stored. If stored close to toxic compounds they could have absorbed them. They may contain polyester. Polyester is not toxic even if studies stated that underwear polyester could reduce sperm motility, sperm count of animals and humans. This happens probably because of an electrostatic field created by the fabric [1].
Fluffy animals available for us should have been stored in a safe place and they can be considered as not toxic.

[1] http://www.ahmedshafik.com/abstract.asp?id=Asu008

Balloons

If made by rubber or latex may cause serious allergic reaction. Some cases of studies record anaphylactic shock by allergic people wearing latex gloves. If balloons are made by polychloroprene (neoprene) allergic reactions are less probable (Directive 1999/45/EC), except in the case if Neoprene contains some adhesive products like colophony. There are not risks if balloons are made by nylon textile [1].

[1] http://www.aafp.org/afp/980101ap/reddy.html

Paint cans

Residues of paint can stay in the cans. Paints can emit VOC's (volatile organic compounds). Binder, solvents and additives of paints can be toxic, irritants if inhaled, ingested [1].

[1] http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1472097/

Cable Reels

Pinewood from cable reels should be safe. It only depends which kind of cable was carried and where the cable reels was stored. This is because wood can easily absorb toxic substances.

Books

Books should be safe. It only depends where the book was stored. This is because cardboard and paper can easily absorb toxic substances.

Acrylic PMMA

Acrylic maquette's materials like Perspex are basically not poisonous and safe. When the material is cut, scratched or sewed it may produce some powder, dust and small pieces. This powder can be compared to the consistency of the pure element as it is sold by the factory to the laboratory/manufacturer. In this case looking at the MSDS (Material Safety Data Sheet) instructions and considering that children will handle the material, it can be interesting to have a look to some precautions as follow. If inhaled: if breathed in, move person into fresh air. If not breathing, give artificial respiration. In case of skin contact: Wash off with soap and plenty of water. In case of eye contact: Flush eyes with water as a precaution [1].

[1] Sigma-Aldrich Company Ltd. (Revision Date 21.01.2011). Poly(methacrylic acid methyl ester), Poly(methyl methacrylate), PMMA. *Safety Data Sheet*.

LIST OF ANNEXES:

1 - European Union, Commission Directive 2005/84/EC of 14 December 2005, amending for the 22nd time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (phthalates in toys and childcare articles).

2 - Sigma-Aldrich Company Ltd. (Revision Date 24.01.2011). Dioctyl phthalate. *Safety Data Sheet*.

3 - A.O. Earls, I.P. Axford, J.H. Braybrook (2003). Gas chromatography–mass spectrometry determination of the migration of phthalate plasticizers from polyvinyl chloride toys and childcare articles. *Journal of chromatography A.*

4 - ELDRA ELECTRO-DRAAD BV. Product specification 20301, Single core non-sheathed cables for internal wiring for a conductor temperature of 90 C.

5 - NEN-EN 50363-3. Insulating, sheathing and covering materials for low voltage energy cables, Part 3: PVC insulating compounds (March 2006).

6 – InterfaceFLOR, Environmental Data Sheets

DIRECTIVE 2005/84/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 14 December 2005

amending for the 22nd time Council Directive 76/769/EEC on the approximation of the laws, regulations and administrative provisions of the Member States relating to restrictions on the marketing and use of certain dangerous substances and preparations (phthalates in toys and childcare articles)

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 95 thereof,

Having regard to the proposal from the Commission [1],

Having regard to the opinion of the European Economic and Social Committee [2],

Acting in accordance with the procedure laid down in Article 251 of the Treaty [3],

Whereas:

(1) Article 14 of the Treaty establishes an area without internal frontiers in which the free movement of goods, persons, services and capital is ensured.

(2) Work on the internal market should improve the quality of life, health protection and consumer safety. This Directive complies with the requirements of ensuring a high level of health protection and of consumer protection in the definition and implementation of all Community policies and activities.

(3) The use of certain phthalates in toys and childcare articles made of plasticised material or including parts made of plasticised material should be prohibited as the presence of certain phthalates presents or could potentially present risks related to the health of children. Toys and childcare articles which, although not intended for that purpose, can be put in the mouth, may under certain circumstances present a risk to the health of small children if they are made of plasticised material, or include parts made of plasticised material, which contains certain phthalates.

(4) The Scientific Committee on Toxicity, Ecotoxicity and the Environment (SCTEE), after being consulted by the Commission, has delivered opinions on the health risks raised by these phthalates.

(5) Commission Recommendation 98/485/EC of 1 July 1998 on childcare articles and toys intended to be placed in the mouth by children of less than three years of age, made of soft PVC containing certain phthalates [4], invited Member States to take measures to ensure a high level of child health protection with regard to these products.

(6) Since 1999, the use of six phthalates in toys and childcare articles intended to be placed in the mouth by children under the age of three is subject to a temporary ban at European Union level following the adoption of Commission Decision 1999/815/EC [5] in the framework of Council Directive 92/59/EEC of 29 June 1992 on general product safety [6]. This Decision is being renewed regularly.

(7) Limitations already adopted by certain Member States on the placing on the market of toys and childcare articles because of their phthalate content directly affect the completion and functioning of the internal market. It is therefore necessary to approximate the laws of the Member States in this field and consequently to amend Annex I to Directive 76/769/EEC [7].

(8) The precautionary principle should be applied where scientific evaluation does not allow the risk to be determined with sufficient certainty in order to ensure a high level of protection of health, in particular for children.

(9) Children as developing organisms are particularly vulnerable to reprotoxic substances. Therefore, the exposure of children to all practically avoidable sources of emissions of these substances, especially from articles which are put into the mouth by children, should be reduced as far as possible.

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[1] OJ C 116 E, 26.4.2000, p. 14.

[2] OJ C 117, 26.4.2000, p. 59.

[3] Opinion of the European Parliament of 6 July 2000 (OJ C 121, 24.4.2001, p. 410), Council Common Position of 4 April 2005 (OJ C 144 E, 14.6.2005, p. 24), Position of the European Parliament of 5 July 2005 (not yet published in the Official Journal) and Council Decision of 23 November 2005.

[4] OJ L 217, 5.8.1998, p. 35.

[5] OJ L 315, 9.12.1999, p. 46. Decision as last amended by Decision 2004/781/EC (OJ L 344, 20.11.2004, p. 35).

[6] OJ L 228, 11.8.1992, p. 24. Directive repealed by Directive 2001/95/EC of the European Parliament and of the Council (OJ L 11, 15.1.2002, p. 4).

[7] OJ L 262, 27.9.1976, p. 201. Directive as last amended by Commission Directive 2004/98/EC (OJ L 305, 1.10.2004, p. 63).

(10) During risk assessments and/or within the framework of 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 [1], di(2-ethylhexyl) phthalate (DEHP), dibutyl phthalate (DBP) and benzyl butyl phthalate (BBP) have been identified as reprotoxic substances and have therefore been classified as reprotoxic, category 2.

(11) Scientific information regarding di-isononyl phthalate (DINP), di-isodecyl phthalate (DIDP) and di-n-octyl phthalate (DNOP) is either lacking or conflictual, but it cannot be excluded that they pose a potential risk if used in toys and childcare articles, which are by definition produced for children.

(12) The uncertainties in the evaluation of exposure to these phthalates, such as mouthing times and exposure to emissions from other sources, require that precautionary considerations be taken into account. Therefore, restrictions on the use of these phthalates for toys and childcare articles and on the placing on the market of such articles should be introduced. However, the restrictions for DINP, DIDP and DNOP should be less severe than the ones proposed for DEHP, DBP and BBP for reasons of proportionality.

(13) The Commission should review other applications of articles made from plasticised material or including parts made from plasticised material which may expose people to risks, especially those used in medical devices.

(14) In line with the Commission Communication on the Precautionary Principle, the measures based on this principle should be subject to review in the light of new scientific information.

(15) The Commission, in cooperation with the Member State authorities responsible for market surveillance and enforcement for toys and childcare articles, and in consultation with the relevant organisations of producers and importers, should monitor the use of phthalates and other substances as plasticisers in toys and childcare articles.

(16) For the purpose of Directive 76/769/EEC, the term 'childcare article' should be defined.

(17) In accordance with paragraph 34 of the Interinstitutional Agreement on Better Law-making [2], Member States are encouraged to draw up, for themselves and in the interest of the Community, their own tables illustrating, as far as possible, the correlation between this Directive and the transposition measures, and to make them public.

(18) The Commission will review the use of the phthalates listed in Annex I to Directive 76/769/EEC in other products when the risk evaluation under Council Regulation (EEC) No 793/93 of 23 March 1993 on the evaluation and control of the risks of existing substances [3] will have been concluded.

(19) This Directive applies without prejudice to Community legislation laying down minimum requirements for the protection of workers contained in Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work [4] and in individual directives based thereon, in particular Council Directive 90/394/EEC of 28 June 1990 on the protection of workers from the risks related to exposure to carcinogens at work [5] and Council Directive 98/24/EC of 7 April 1998 on protection of health and safety of workers from the risk related to chemical agents at work [6],

HAVE ADOPTED THIS DIRECTIVE:

Article 1

Directive 76/769/EEC is amended as follows:

1. the following point shall be added to Article 1(3):

'(c) "childcare article" means any product intended to facilitate sleep, relaxation, hygiene, the feeding of children or sucking on the part of children.';

2. Annex I shall be amended as set out in the Annex to this Directive.

[1] OJ 196, 16.8.1967, p. 1. Directive as last amended by Commission Directive 2004/73/EC (OJ L 152, 30.4.2004, p. 1).

[2] OJ C 321, 31.12.2003, p. 1.

[3] OJ L 84, 5.4.1993, p. 1. Regulation as amended by Regulation (EC) No 1882/2003 of the European Parliament and of the Council (OJ L 284, 31.10.2003, p. 1).

[4] OJ L 183, 29.6.1989, p. 1. Directive as amended by Regulation (EC) No 1882/2003.

[5] OJ L 196, 26.7.1990, p. 1. Directive repealed by Directive 2004/37/EC of the European Parliament and of the Council (OJ L 158, 30.4.2004, p. 50).

[6] OJ L 131, 5.5.1998, p. 11.

Article 2

The Commission shall re-evaluate, by 16 January 2010 at the latest, the measures provided for in Directive 76/769/EEC as amended by this Directive in the light of new scientific information on substances described in the Annex to this Directive and their substitutes, and if justified, these measures shall be modified accordingly.

Article 3

1. By 16 July 2006 Member States shall adopt and publish the laws, regulations and administrative provisions necessary to comply with this Directive. They shall forthwith inform the Commission thereof.

They shall apply these measures from 16 January 2007.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such reference shall be laid down by Member States.

2. Member States shall communicate to the Commission the text of the main provisions of national law which they adopt in the field covered by this Directive.

Article 4

This Directive shall enter into force on the 20th day following its publication in the *Official Journal of the European Union*.

Article 5

This Directive is addressed to the Member States.

Done at Strasbourg, 14 December 2005.

For the European Parliament	*For the Council*
The President	*The President*
J. BORRELL FONTELLES	C. CLARKE

ANNEX

The following points shall be added to Annex I to Directive 76/769/EEC:

'[XX.] The following phthalates (or other CAS- and EINECS numbers covering the substance): bis (2-ethylhexyl) phthalate (DEHP) CAS No 117-81-7 Einecs No 204-211-0 dibutyl phthalate (DBP) CAS No 84-74-2 Einecs No 201-557-4 benzyl butyl phthalate (BBP) CAS No 85-68-7 Einecs No 201-622-7	Shall not be used as substances or as constituents of preparations, at concentrations of greater than 0,1 % by mass of the plasticised material, in toys and childcare articles. Such toys and childcare articles containing these phthalates in a concentration greater than the limit mentioned above shall not be placed on the market.
[XXa.] The following phthalates (or other CAS- and EINECS numbers covering the substance): di-"isononyl" phthalate (DINP) CAS No 28553-12-0 and 68515-48-0 Einecs No 249-079-5 and 271-090-9 di-"isodecyl" phthalate (DIDP) CAS No 26761-40-0 and 68515-49-1 Einecs No 247-977-1 and 271-091-4 di-n-octyl phthalate (DNOP) CAS No 117-84-0 Einecs No 204-214-7	Shall not be used as substances or as constituents of preparations, at concentrations of greater than 0,1 % by mass of the plasticised material, in toys and childcare articles which can be placed in the mouth by children. Such toys and childcare articles containing these phthalates in a concentration greater than the limit mentioned above shall not be placed on the market.'

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006
Version 4.1 Revision Date 27.01.2011
Print Date 08.02.2011

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifiers

Product name : Dioctyl phthalate

Product Number : D201154
Brand : Aldrich
Index-No. : 607-317-00-9
CAS-No. : 117-81-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Company Ltd.
The Old Brickyard
NEW ROAD, GILLINGHAM
Dorset
SP8 4XT
UNITED KINGDOM

Telephone : +441747833000
Fax : +441747833313
E-mail address : eurtechserv@sial.com

1.4 Emergency telephone number

Emergency Phone # : +44 (0)1747 833100

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Reproductive toxicity (Category 1B)

Classification according to EU Directives 67/548/EEC or 1999/45/EC
May impair fertility. May cause harm to the unborn child.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]

Pictogram

Signal word Danger

Hazard statement(s)
H360Fd May damage fertility. Suspected of damaging the unborn child.

Precautionary statement(s)
P201 Obtain special instructions before use.
P308 + P313 IF exposed or concerned: Get medical advice/ attention.

Supplemental Hazard Statements none

According to European Directive 67/548/EEC as amended.

Hazard symbol(s)

R-phrase(s)

R60	May impair fertility.
R61	May cause harm to the unborn child.

S-phrase(s)

S53	Avoid exposure - obtain special instructions before use.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

Restricted to professional users.

2.3 Other hazards - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms : Bis(2-ethylhexyl) phthalate
Phthalic acid bis(2-ethylhexyl ester)

Formula : $C_{24}H_{38}O_4$

Molecular Weight : 390.56 g/mol

Component		Concentration
bis(2-Ethylhexyl) phthalate Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)		
CAS-No.	117-81-7	-
EC-No.	204-211-0	
Index-No.	607-317-00-9	

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

Lung irritation, Gastrointestinal disturbance

4.3 Indication of immediate medical attention and special treatment needed

no data available

5. FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Precautions for fire-fighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid exposure - obtain special instructions before use.Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Normal measures for preventive fire protection.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end uses
no data available

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
bis(2-Ethylhexyl) phthalate	117-81-7	STEL	10 mg/m3	UK. EH40 WEL - Workplace Exposure Limits
		TWA	5 mg/m3	UK. EH40 WEL - Workplace Exposure Limits

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of

contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Body Protection
impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	no data available
e)	Melting/freezing point	Melting point/range: -50 °C - lit.
f)	Initial boiling point and boiling range	384 °C - lit.
g)	Flash point	207 °C - closed cup
h)	Evaporation rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	Lower explosion limit: 0.3 %(V)
k)	Vapour pressure	1.6 hPa at 93.0 °C
l)	Vapour density	no data available
m)	Relative density	0.985 g/cm3 at 25 °C
n)	Water solubility	no data available
o)	Partition coefficient: n-octanol/water	no data available
p)	Autoignition temperature	390.0 °C
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
no data available

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 30,000 mg/kg

LD50 Dermal - rabbit - 25,000 mg/kg

Skin corrosion/irritation
Skin - rabbit - Mild skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - rabbit - Mild eye irritation - 24 h

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (bis(2-Ethylhexyl) phthalate)

Reproductive toxicity
May cause congenital malformation in the fetus.
Presumed human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure
Lung irritation, Gastrointestinal disturbance

Additional Information
RTECS: TI0350000

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - > 0.67 mg/l - 96 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - > 0.32 mg/l - 96 h
	LC50 - Cyprinodon variegatus (sheepshead minnow) - > 0.17 mg/l - 96 h
	LC50 - Lepomis macrochirus (Bluegill) - > 0.20 mg/l - 96 h
	LC50 - Daphnia magna (Water flea) - > 0.16 mg/l - 96 h
	NOEC - other fish - > 0.3 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates.	Immobilization EC50 - Daphnia magna (Water flea) - > 0.16 mg/l - 48 h

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
Bioaccumulation — Oncorhynchus mykiss (rainbow trout) - 100 d -0.014 mg/l
Bioconcentration factor (BCF): 113

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
no data available

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

14.1 UN-Number
ADR/RID: 3082 IMDG: 3082 IATA: 3082

14.2 UN proper shipping name
ADR/RID: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (bis(2-Ethylhexyl) phthalate)
IMDG: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (bis(2-Ethylhexyl)

phthalate)
IATA: Environmentally hazardous substance, liquid, n.o.s. (bis(2-Ethylhexyl) phthalate)

14.3 Transport hazard class(es)

ADR/RID: 9	IMDG: 9	IATA: 9

14.4 Packaging group

ADR/RID: III	IMDG: III	IATA: III

14.5 Environmental hazards

ADR/RID: yes	IMDG Marine pollutant: yes	IATA: yes

14.6 Special precautions for users

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
no data available

15.2 Chemical Safety Assessment
no data available

16. OTHER INFORMATION

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

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Gas chromatography–mass spectrometry determination of the migration of phthalate plasticisers from polyvinyl chloride toys and childcare articles

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Abstract

Two laboratory-based linear horizontal agitation methods for determining a range of phthalate esters from soft polyvinyl chloride (PVC) toys are presented in compliance with EU legislation. Both of these methods were validated through interlaboratory trials using a PVC reference disc and four soft PVC toy/childcare articles intended or likely to be mouthed. Two of these commercial samples contained diisononyl phthalate (DINP), one diisodecyl phthalate (DIDP) and one bis(2-ethylhexyl) phthalate (DEHP). Acceptable repeatability (*r*, within-laboratory) and reproducibility (*R*, between-laboratory) data were demonstrated for both the analytical detection technique (GC–MS) ($r=9.8\%$ and $R=8.1\%$) and agitation/extraction procedure ($r=21.9\%$ and $R=35.3\%$ at 37 °C; $r=22.7\%$ and $R=31.1\%$ at 65 °C) for DINP. This was achieved through the participation of six laboratories. The remaining three phthalates from the EU Scientific Committee for Toxicity, Ecotoxicity and the Environment (CSTEE) list—dibutyl phthalate (DBP), benzyl butyl phthalate (BBP) and di-*n*-octyl phthalate (DnOP)—were not tested due to the unavailability of suitable materials.

Keywords: Agitation methods; Migration; Toys; Phthalates; Poly(vinyl chloride)

Phthalic acid esters (''phthalates'') are the most commonly used plasticizers in polyvinyl chloride (PVC) based products due to their compatibility and softening capability [1]. The plasticiser content can be up to 50% by weight. Although named as diesters of phthalic acid (benzene 1,2-dicarboxylic acid), they are produced by the esterification of phthalic anhydride with long-chained alcohols (C7–C10). They have widespread use in consumer products such as children's toys, childcare articles, and household and industrial hardware including electrical cabling, PVC flooring and water pipes. Additional sources of these chemicals are PVC Infusion Lines, exposing infants to large amounts of plasticizer [2].

Several techniques have been described for the determination of phthalates. Reversed-phase high-performance liquid chromatography (HPLC), for instance, is used for the determination of DBP, DEHP and DIDP in industrial emissions [3]. BBP, DEHP and DIDP were analysed in total diet samples, baby food and infant formulae by gas chromatog-

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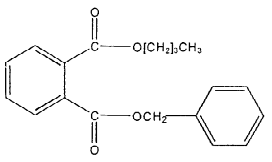
raphy–mass spectrometry (GC–MS) operated in selected ion monitoring (SIM). Identification was based on comparison of retention time and ion ratios for each of the target analytes [4]. Additional procedures have been described for the qualitative identification of plasticizers in medical products by GC–MS, and for total phthalate content in toy materials by GC–FID (flame ionisation detector) [5,6]. Limited methods are available on the migration of these substances from PVC toys into artificial simulants, however one method describes the migration of DINP and DEHP in saliva simulant using the ''Head over Heels'' agitation method with HPLC [7].

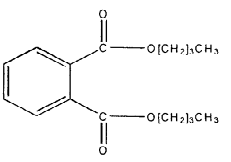
The phthalates (see Table 1 for structures and abbreviations) have been found to migrate from PVC-based toys and childcare articles, especially those which are known to be mouthed—DEHP and DINP being the most common. Based on opinions, the CSTEE has established migration limits for each of these phthalates from available toxicological data; up-to-date information should be sought when addressing this issue. The CSTEE working group assessed the health risk to children exposed to phthalates in toys. An exposure dose was calculated from the maximum amounts which migrated when a surrogate for a phthalate containing PVC-toy of 10 cm^2 is extracted for 3 h by a model saliva solution under dynamic conditions. Risk assessments were based on a body weight of an infant of 8 kg. This may be a worse case approach since there is not a standardised or validated extraction method. Critical effects for the phthalates were assessed with a margin of safety. NOAEL (No-Observed-Adverse-Effect-Level) values were identified for four phthalates (DINP, DnOP, DEHP, DIDP) and L(lowest)OAEL for the two remaining phthalates, DBP and BBP. From this information safety margins were incorporated between the NOAEL and exposure data. As a result of these findings, the CSTEE recommended the following guideline values for maximum permissible extracted amounts (for a child of 8 kg body weight); 0.8 mg DBP, 3.0 mg DnOP, 0.3 mg DEHP, 1.2 mg DINP, 2.0 mg DIDP and 1.6 mg BBP per 10 cm^2 of article mouthed over a 3 h time period. Hazards associated with phthalates such as DEHP include reproductive toxicity and teratogenesis, and malformed offspring in mice [8]. A recent publication describes the relationship between testicular cancer and occupational exposure to PVC containing phthalate plasticizers [9]. A review and risk assessment on the potential toxicity effects of DINP, exposure levels of children to DINP migrating from PVC products, and a risk assessment of the potential adverse effects has been documented [10]. A comprehensive evaluation of the health effects of DEHP details human and animal health effects and provides toxicological information after its exposure and relevance to public health [11].

This paper describes two methods for the determination of the migration of phthalates into saliva. They are based on linear horizontal agitation, and have been validated by interlaboratory trial [12]. GC–MS was employed to provide the analytical

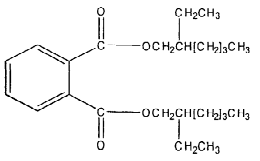
Table 1
Structures of six phthalate components with defined limits for migration from childcare articles and toys set by the CSTEE



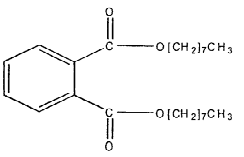
Benzyl butyl phthalate (BBP)



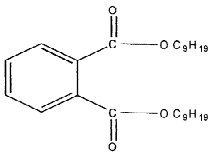
Dibutyl phthalate (DBP)



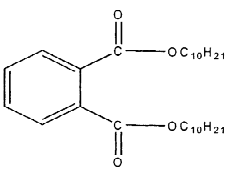
Bis(2-ethylhexyl) phthalate (DEHP)



Di-n-octyl phthalate (DnOP)



Diisononyl phthalate (DINP)



Diisodecyl phthalate (DIDP)

Both DINP and DIDP are mixtures of isomers.

specificity for ensuring conformity of PVC toy and childcare articles with the CSTEE migration limits.

1. Migration test methods

Most analytical test methods are developed to measure the total concentration of a component in a test material. Migration methods, on the other hand, are intended to determine the extent to which a component can be extracted from a test material under conditions relevant to real-life activities, and the results are dependent on conditions of migration. In comparison with total concentration method results, good statistical agreement between migration results is difficult to obtain. Generally, the relative concentrations of a group of substances in a sample are not reflected in their relative recoveries from migration tests, because the spatial distribution and kinetics of release of the component contribute to the result. Two mechanical test methods (''Simulated'' and ''Stringent''), which mimic the way phthalates migrate from PVC-based products, have been developed at the LGC (Laboratory of the Government Chemist). The methods are based on linear horizontal agitation under strictly controlled conditions of temperature, mode of mechanical agitation (pounding), agitation frequency, contact time (including ''continuous'' and ''replenishment'' testing), and volume and content of saliva simulant. The methods are aimed at representing the human oral environment as far as is practicable in the laboratory. One of the main difficulties in developing a laboratory-based (in vitro) phthalate migration method for childcare articles has been the lack of validated in vivo oral migration data from children. The Dutch Consensus Group (DCG) has provided data derived from child observation and in vivo adult ''chew and spit'' studies [13]; a standard PVC disc and two forms of a ''commercial'' soft PVC sample were used. Additional data on in vivo adult ''chew and spit'' studies on ''standard PVC sheet'' and ''commercial'' soft PVC samples has been provided by Steiner et al. [14].

Both the ''Simulated'' and ''Stringent'' methods have been designed to correspond closely with the mean oral contact time of young children with toys, and with mean adult in vivo migration levels of phthalates from PVC toys. A 10 cm^2 total surface area was selected to correspond to the surface area of a child's open mouth, as this gives the typical surface area available for mouthing at any one time. The difference between these methods is temperature and mode of agitation. To establish conditions for the Stringent method, which aims to achieve the target migration value of 9 $\mu g/10\ cm^2/min$ for DINP, the PVC reference disc was analysed at four alternative temperatures (37, 50, 60 and 70 °C), increasing temperature clearly indicating a near exponential increase in plasticiser migration (Fig. 1). The target value was achieved between 60 and 70 °C. The target migration value was set by CSTEE on the basis of the DCG human volunteer study. In contrast, the Simulated method aims to reflect physiological conditions more closely. Because of the safety hazards and impracticalities of using human saliva in a laboratory-method, a saliva simulant was preferred. In this study, a Dutch saliva simulant was adopted for the determination of phthalate migration. A 100 ml/h (10 ml/cm^2 per h) volume was selected, mimicking the mean rate of saliva production stimulated by active mouthing of an object by adults (1.5 ml/min). Two methods of ''contact'' were studied—namely, continuous testing and replenishment. Continuous testing involves contact of test sample with a single portion of saliva over a fixed interval. Replenishment is the removal of saliva in contact with the test material and replacement with a fresh portion; this may occur once or more over the interval determined for the whole test. Replenishment is

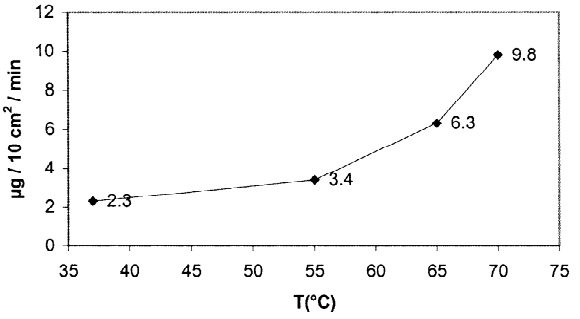


Fig. 1. Effect of temperature on mean migration level of DINP. The PVC reference disc was analysed by the stringent method at four alternative temperatures.

more representative of the realistic use of toy and childcare articles.

2. Methodology

Because of the ubiquity of plasticizers, and the tendency of residues to persist, all glassware is washed before and after use, acid rinsed with 5% nitric acid, rinsed with distilled water and further rinsed with acetone–methanol (1:1, v/v), then dried. Samples need to be stored so that they are not in contact with plasticised surfaces. New batches of chemicals, reagents and distilled water were screened before use in analytical determinations, for instance by evaporation and concentration of organic solvents to measure background levels of phthalates by GC–MS.

3. Test samples and sampling

A PVC-based reference sheet of known composition (38.5% DINP) and origin was used to validate both migration methods. Samples measuring approximately 10 cm^2 (total surface area) was accurately measured with a ''metal punch'' and rinsed in deionised water. Toys were selected and purchased from retail outlets as additional standard items, representing different phthalates and levels of migration. A blank sample, without the reference disc was analysed with each batch of toy samples to measure background levels within the extraction method.

4. Chemicals and reagents

HPLC grade dichloromethane, *n*-hexane and propan-2-ol were from Fisher Scientific, Loughborough, UK and Sigma–Aldrich, Poole, UK. Components of the saliva simulant were from Fisher Scientific. Phthalate standards of 99% purity, were from Sigma–Aldrich.

5. Saliva simulant solution

The Dutch saliva solution comprised: 0.82 m*M* magnesium chloride (0.08 g/l), 1.0 m*M* calcium chloride (0.11 g/l), 3.3 m*M* di-potassium hydrogen phosphate (0.57 g/l), 3.8 m*M* potassium carbonate (0.52 g/l), 5.6 m*M* sodium chloride (0.33 g/l), and 10 m*M* potassium chloride (0.75 g/l). The potassium and sodium salts were dissolved in distilled water before adding the magnesium and calcium salts and making up to 1 l. The pH of the solution was adjusted to 6.8 by dropwise addition of 3 mol/l hydrochloric acid.

6. Migration methods

The samples were agitated in a Grant SS40-2 linear/horizontal shaking water bath.

6.1. Simulated method

A 10 cm^2 test sample was placed in a 250 ml glass conical flask with 50 ml saliva simulant solution (pre-heated to 37 °C) and 10 glass balls, ensuring complete submersion of the sample. The flask was stoppered and placed in a shaking waterbath at 37 °C for 60 min, with an amplitude of movement (stroke length) of 38 mm and an agitation speed of 200 strokes/min. After 30 min the saliva simulant solution was replenished, and a second 50 ml portion of saliva added. The two portions of saliva were combined, and extracted with three successive 25 ml portions of dichloromethane. The extracts were combined and reduced to about 5 ml in a Kuderna–Danish (KD) evaporator. The final 5 ml of dichloromethane was taken to dryness under nitrogen flow and made to 2 ml in *n*-hexane.

6.2. Stringent method

The Stringent method was performed identically with the simulated method, except that the saliva simulant solution was at a temperature of 65 °C and stainless steel balls were used.

7. GC–MS for the identification and confirmation of phthalates

GC–MS was chosen for determination of phtha-

late plasticizers because it is highly specific and now widely available. For complete confidence, particularly where results exceed regulatory limits or are questionable, the GC–MS should comply with certain criteria: the chromatogram has peaks with the expected retention times and acceptable peak symmetry with minimal tailing. Peaks for interfering ions in excess of 25% of the base peak are absent; the relative responses of the qualifier ions to the quantifying ion are within an acceptable range of 10%. The most abundant ion formed in the mass spectrometer is called the base peak. In the mass spectra of phthalates the base peak is indicated at the m/z value 149, for this determination this is referred to as the target ion for quantification. The relative abundance of other peaks in the spectrum is expressed as percentages of the abundance of the quantifying ion.

7.1. GC–MS conditions

Phthalate analysis was performed on a Hewlett–Packard model 5890 Series II gas chromatograph fitted with a HP5971A mass-selective detector.

Separation was performed with a DB-17HT (50% dimethyl–50% diphenyl polysiloxane) GC column, 30 m, 0.25 mm ID with a film thickness of 0.15 μm. The column was held at 60 °C for 3 min, ramped at 10 °C/min to 290 °C, and finally held for 10 min. The gas chromatograph was operated in split/splitless injection mode at a temperature of 290 °C. The operating temperature of the MSD was 280 °C. A HP 5971 mass selective detector was used in full scan electron ionisation (EI) mode, and data were acquired over the range m/z 50–500.

8. Results and discussion

GC–MS was chosen for the analysis of phthalates in PVC-based childcare articles and toys. Although selected ion monitoring (SIM) provides higher sensitivity, all analyses were performed in full scan mode, allowing additional identification. Identification and quantification of PVC used the extracted ion m/z 149 for each of the phthalates under test. The confirmation of presence was monitored by the following qualifier ions which are summarised in Table 2; m/z 279 (DEHP and DnOP), m/z 223 (DBP), m/z 91 (BBP), m/z 293 (DINP) and m/z 307 (DIDP). Calibration standards of 2, 5, 10, 15 and 20 μg/ml were prepared in *n*-hexane for DEHP, DnOP, DBP and BBP and 50, 100, 200, 400 and 500 μg/ml for DINP and DIDP. These concentrations include both extremes of the concentration range expected in test materials. Because of co-elution of three of these phthalates, two separate mixtures were prepared for these standards, one containing DBP, DEHP, BBP and DINP and the second DnOP and DIDP. From Figs. 2 and 3 it can be noted that two of these phthalates, namely diisononyl phthalate (DINP) and diisodecyl phthalate (DIDP), are mixtures of many isomers, and are detected as correspondingly broad peaks, which take about 2 min to elute.

In order to construct a calibration line, a regression of peak area abundance on concentration was undertaken using the external standard calibration method. The total areas of each analyte were processed from the ion abundance of the quantifying ion followed by confirmation using the qualifier ions

Table 2
GC–MS retention times (t_R), with quantifying and qualifier ions for the six phthalate compounds listed by the CSTEE

Compound	t_R (min)	Quant ion (m/z)	Qualifier 1 $(M-R)^+$	$(M-OR)^+$	% Abundance	Qualifier 2	% Abundance
Dibutyl phthalate	19.18	149	223		3.10	205	2.40
Bis(2-ethylhexyl) phthalate	23.48	149	279		6.20	167	29.90
Benzyl butyl phthalate	23.98	149		206	14.6	91	64.7
Di-n-octyl phthalate	24.49	149	279		7.56	261	2.10
Diisononyl phthalate	24.0–26.5	149	293		13.11	167	2.20
Diisodecyl phthalate	25.0–27.5	149	307		12.12	167	2.32

The qualifier ions were indicated by the NIST mass spectral library software incorporated into the software and may serve as target ions depending on the presence of additional phthalates not present on the CSTEE list. The percentage abundance is the relative intensity to the quantifying ion. The reference standards were prepared in *n*-hexane and injected directly onto GC–MS.

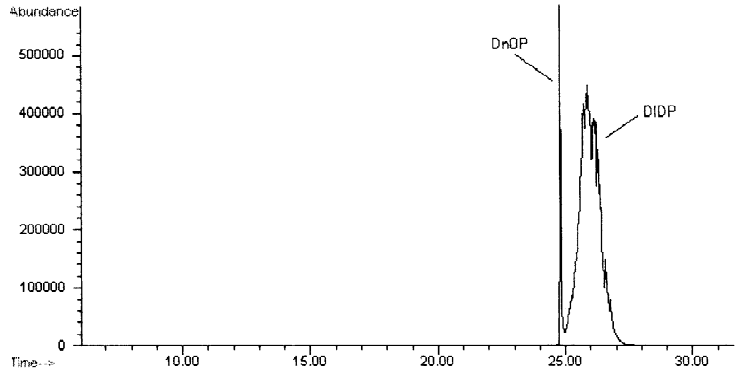


Fig. 2. Total ion chromatogram of di-*n*-octyl phthalate and diisodecyl phthalate in full scan mode. Temperature programme and MS parameters are in GC–MS conditions.

summarised in Table 2. Replicate measurements ($n=15$) on the ion abundance ratios for each phthalate was determined to calculate the precision of the calibration, and the relative standard deviations of the qualifier to the quantifying ion. The relative standard deviations on the relative abundances did not exceed 10% for all the phthalates tested. Additionally, where phthalates have similar fragmentation patterns (DnOP and DEHP), identification was by retention time. Good linearity of response was achieved for all phthalates with coefficient of correlation (r^2)>0.990. In full scan electron impact (EI) mode the limits of detection (LOD) [15] were calculated as three times the background noise, with values of the order of 0.1 μg/ml for the single isomers, and the limits of quantitation (LOQ) [15] as ten times the LOD with values of the order of 1 μg/ml. The LOD for DINP and DIDP were based on the lowest discriminating response for each of the isomeric profiles, with values between 2.5 and 3.5 μg/ml.

All phthalates, with the exception of dimethyl phthalate, show an intense characteristic base peak at *m/z* 149. Other peaks (Figs. 4 and 5) may be explained by double hydrogen transfer (DHT) [16,17]. The transfer of a single hydrogen gives rise to even mass ions that are of low intensity and may not be observed in the mass spectra. In the fragmentation pattern of DEHP (Fig. 6), two hydrogen atoms are transferred from the parent ion to the *m/z* 279 fragment. This ion is two mass units heavier than the cleaved fragment would be if unmodified.

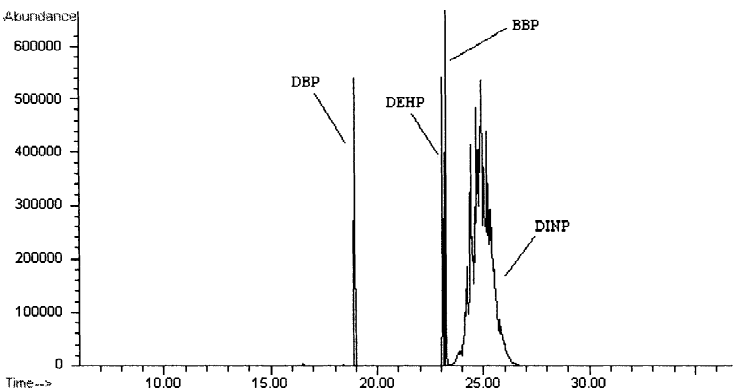


Fig. 3. Total ion chromatogram of dibutyl phthalate, bis(2-ethylhexyl) phthalate, benzyl butyl phthalate and diisononyl phthalate in full scan mode. Temperature programme and MS parameters are in GC–MS conditions.

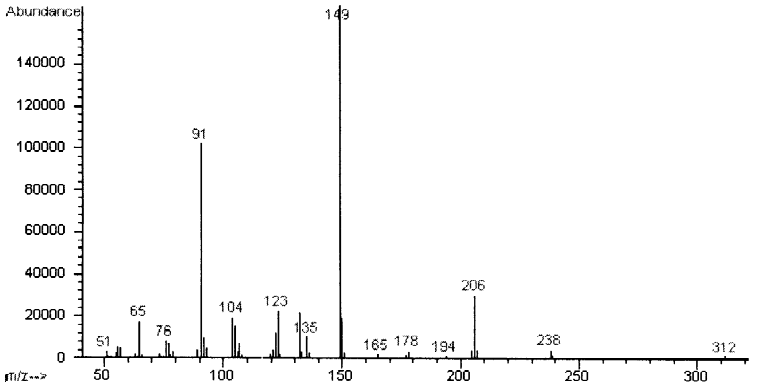


Fig. 4. Mass spectrum of benzyl butyl phthalate showing the base peak at m/z 149 and the qualifier ions at their relative intensities at m/z 91 and 206.

The molecular ion peak for phthalate compounds with long chain alkyl groups is usually weak and not always present in the mass spectra, but the $(M–R)^+$ and $(M–OR)^+$ (R = alkyl group) fragments can be a secondary form of identification. In the mass spectrum of BBP (Fig. 7) the presence of a highly abundant peak at m/z 91 is characteristic of the resonance stabilised benzyl cation ($C_6H_5 \cdot CH_2^+$).

Both migration methods were successfully validated through interlaboratory trial. The analytical data were subjected to statistical analysis [18,19]. The within laboratory repeatability and between laboratory reproducibility for the GC–MS and the agitation/extraction methods for the PVC reference disc were determined and are summarised in Tables 3–5. These results suggest that substantial variation is likely to arise from the agitation/extraction procedure. The repeatability for this method describes the precision expected from a set of replicate measurements made by a single laboratory with the same analyst, instrument and MS parameters, i.e. tuning. This gives an indication of the variation within method measurements. The standard deviation is used to calculate a repeatability limit ''*r*''. Reproducibility measurements are made by several laboratories, different analysts, instruments and tuning parameters. This gives the variation expected between sample measurements made in different laboratories. In this instance the reproducibility limit ''*R*'' is expressed.

The recoveries for the extraction methods, determined by six laboratories at the target spiking levels of 200 μg/ml for both DINP and DIDP, and 10 μg/ml for DEHP, ranged from 86 to 90% (Tables

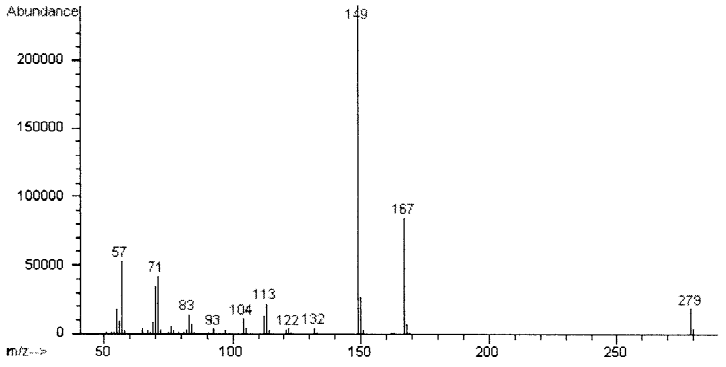


Fig. 5. Mass spectrum of bis(2-ethylhexyl) phthalate showing the base peak at m/z 149 and the qualifier ions at their intensities at m/z 279 and 167.

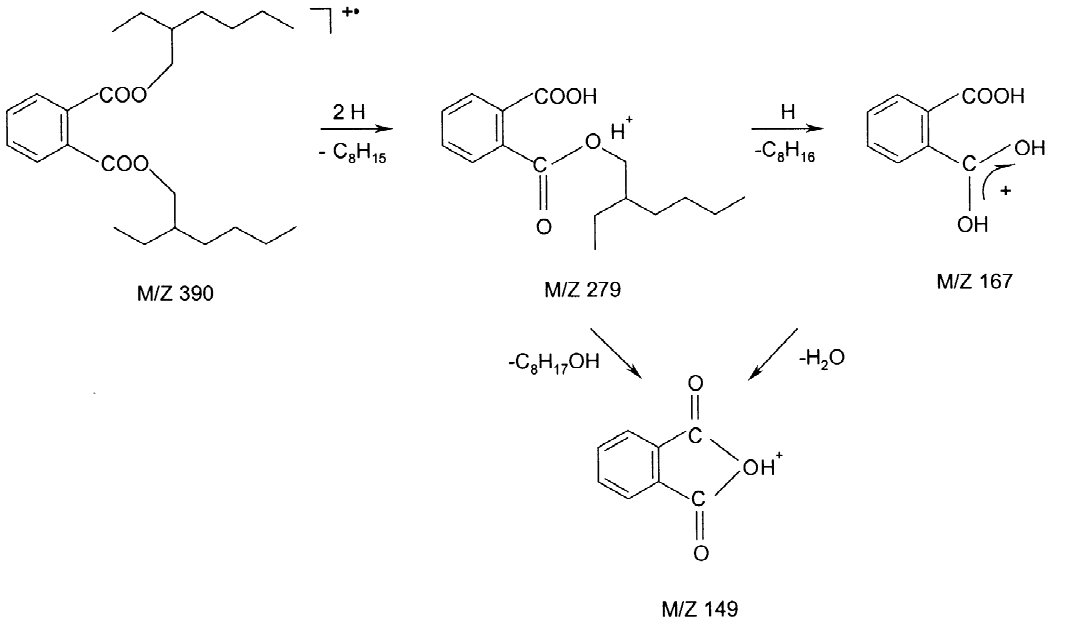


Fig. 6. General structure and characteristic fragmentation pattern of bis(2-ethylhexyl) phthalate.

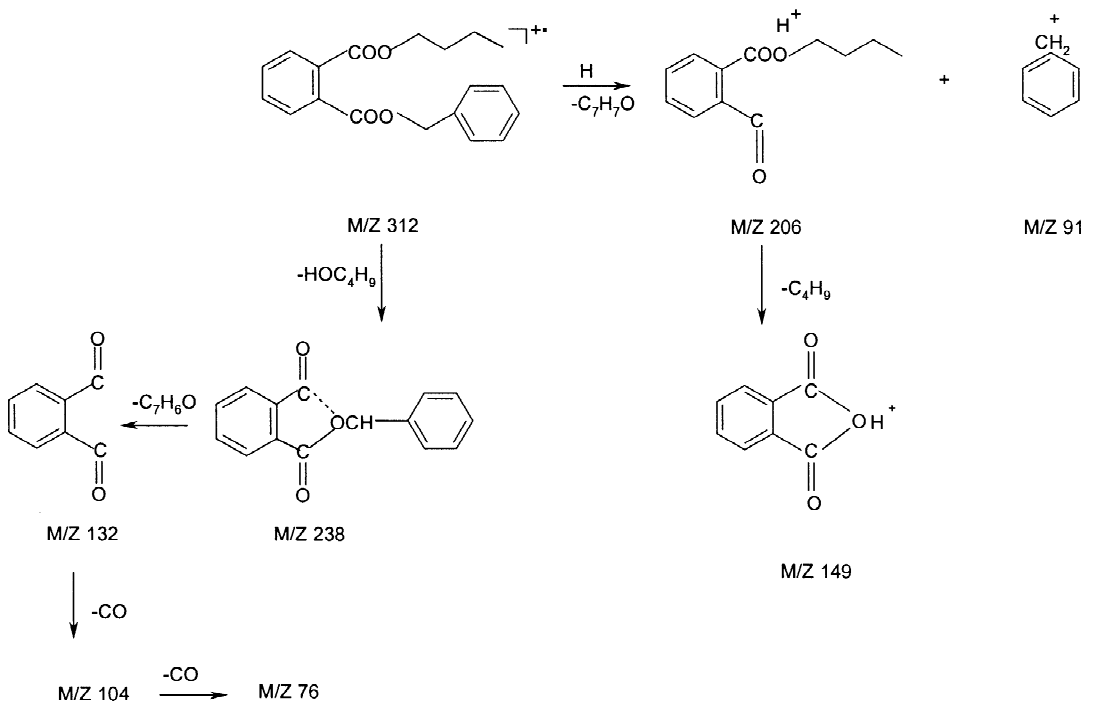


Fig. 7. General structure and characteristic fragmentation pattern of benzyl butyl phthalate.

Table 3
GC–MS repeatability (r) and reproducibility (R) determined from the results of all participating laboratories

Solution tested (μg/ml)	Mean (μg/ml)	C.V.% (r)[a]	C.V.% (R)[a]
DINP 250	253.9	9.8	8.1
DIDP 250	261.7	7.7	8.5
DEHP 10	11.0	11.4	11.9

Pure phthalate compounds were prepared in *n*-hexane and analysed by injecting onto GC–MS.

[a] C.V.% (r) = S_r/x where S_r is the repeatability standard deviation and x is the observed mean of the data. C.V.% (R) = S_R/x (S_R is reproducibility standard deviation).

4 and 5). Repeatability coefficients of variation (C.V.) ranged from 6.8 to 14.6%. Each analysis included a blank determination of the saliva simulant without the reference sample. Due to the background levels of phthalates in the method materials, trace amounts of DBP and DEHP were detected and blank subtracted from sample results

Each laboratory performed at least five replicate tests with the PVC reference disc. The mean migration values (1.43 μg/10 cm^2/min at 37 °C and 8.8 μg/10 cm^2/min at 65 °C) compared favourably with those from the DCG adult volunteer study, 1.4 μg/10 cm^2/min and 9.0 μg/10 cm^2/min, respectively.

Table 4
Migration test results—Simulated method—from the results of all participating laboratories

	Mean (%)	C.V.% (r)	C.V.% (R)
Solution tested			
DINP recovery (200 μg/ml)	90.0	8.4	
DIDP recovery (200 μg/ml)	87.1	14.6	
DEHP recovery (10 μg/ml)	86.4	6.8	
Repeatability and reproducibility of PVC disc			
DINP PVC reference disc	1.43[a]	21.9	35.3
Phthalate release from test samples			
DINP-fruit teether	0.7[a]	37.4	
DIDP-bath animal	1.2[a]	64.2	
DEHP-high chair	1.6[a]	39.4	
DEHP swimming armband	1.2[a]	5.5	

Recovery solutions were prepared in propan-2-ol, diluted in saliva simulant solution and extracted with dichloromethane. The extract was finally prepared in *n*-hexane for GC–MS analysis.

[a] μg/10 cm^2/min.

Table 5
Migration test results—Stringent method—from the results of all participating laboratories

	Mean (%)	C.V.% (r)	C.V.% (R)
Solution tested			
DINP recovery (200 μg/ml)	89.9	12.2	
DIDP recovery (200 μg/ml)	88.0	11.8	
DEHP recovery (10 μg/ml)	88.0	13.3	
Repeatability and reproducibility of PVC disc			
DINP PVC reference disc	8.8[a]	22.7	31.1
Phthalate release from test samples			
DINP-fruit teether	5.0[a]	23.3	
DIDP-bath animal	3.9[a]	33.1	
DEHP-high chair	4.1[a]	25.21	
DEHP swimming armband	3.1[a]	48.5	

See Table 4 for experimental detail.

[a] μg/10 cm^2/min.

The reproducibility C.V. (R) for all laboratories was similar for the two methods and is summarised in Tables 4 and 5. The differences in migration test results for commercial samples may be attributable to the morphology of individual test specimens, e.g. flexible, thin sheet materials and thick materials with exposed cut edges, and any variation in the preparation of the test samples. Preparation was a standardised procedure, but was performed individually by each participating laboratory. Although it would be preferable to test the toy and childcare articles in whole form, this is not practical, as the outer surface is the only area available to a child during mouthing. As a result, a 10 cm^2 sample area (total surface area including cut edge if the thickness of the test article is ≥1 mm) was prepared by punching with a ''metal punch''. The close agreement of the results with the Dutch human volunteer studies has been demonstrated. The Stringent method is most suitable for the assessment of toy and childcare articles intended to be mouthed, given that it meets the CSTEE target migration value of 9 μg/10 cm^2/min for DINP from the PVC reference material.

This study represents participating laboratories' first attempts at both the Simulated and Stringent methods. There are therefore strong grounds for anticipating that reproducibility would be improved on their repeated use of the methods.

Acknowledgements

The authors wish to express their appreciation to the participating laboratories; STR (UK), Boots (UK), Enterprise Ireland (IRE), AIJU (Spain), Biolab (Italy).

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ELDRA
ELECTRO-DRAAD BV

PRODUCT SPECIFICATION **20301**

Single core non-sheathed cables for internal wiringfor a conductor temperature of 90˚ C: H05V2-K and H07V2-K

(Cable Drawing optional)

Construction

Construction

Conductor:	Soft anealed bare copper class 5 according to IEC 60228 0,5-1,0 mm² for H05V2-K 1,5-35 mm² for H07V2-K 50-120mm² for KEMA-KEUR	
Insulation	PVC compound type TI3.according to EN 50363-3	
Colours of insulation	0,5-2,5mm²:	black, blue, brown, yellow/green, red, yellow, orange, white, green, violet and grey
	4 – 16 mm²	black, blue, brown, yellow/green
	≥25mm²	Black, yellow/green
Remark	Colours yellow and green are only certified for the H05V2-K range	

Range

Type	*Diameter appr.. (mm)*	*Weight ca. (kg/km)*	*Max. conductor resistance at 20°C (Ω/km)*
0,5 mm²	2.1	8	39
0,75 mm²	2.3	10.6	26
1 mm²	2.5	13	19.5
1,5 mm²	2.9	18.9	13.3
2,5 mm²	3.6	30	7.98
4 mm²	4.2	44	4.95
6 mm²	4.8	64	3.3
10 mm²	6.1	108	1.91
16 mm²	7.3	162	1.21
25 mm²	8.7	242	0.78
35 mm²	9.9	325	0.554
50 mm²	11.7	475	0.386
70 mm²	14.4	665	0.272
95 mm²	15.4	871	0.206
120 mm²	17.1	1075	0.161

Electrical

Operating voltage U_0/U	300/500 V for H05V2-K 450/750 V for H07V2-K
Tests voltage	2000 V for H05V2-K 2500 V for H07V2-K

Phys /Mech

Temperature range	-20˚C to +90˚C
Bending radius	≥ 7,5 D

General

Standards	According to HD 21.7S2 january 1996 and A1 1999
Marking	Eldra H05V2-K or H07V2-K …. mm² Kema-Keur <HAR> “batchnumber” For sizes 50 mm² and up: type is 07V2-K and only Kema-Keur
Approvals	Kema-Keur ◄HAR► Lloyd’s approval
Suply	In rings, reels and box-wire

Environmental Data Sheet

Blast From The Past

Recycled Content		
Overall Recycled Content	21.3% Pre-Consumer recycled content out of total weight	
Yarn system	100% BCF Solution Dyed Nylon PA 6,6 12.7% Pre-Consumer recycled content in the yarn on average Ranges from 11.2% to 14.5% subject to differences between colours	
Backing system	Graphlex® 27.4% of Pre-Consumer recycled content in the backing	
Carbon Footprint		
Estimated full life-cycle carbon footprint (using standardised method developed by GUT)	Raw materials and Production:	9.7kg CO_2 eq./m^2
	Delivery and installation:	0.4kg CO_2 eq./m^2
	Use (1 year):	0.2kg CO_2 eq./m^2
	End of life (waste to energy):	4.8kg CO_2 eq./m^2
	TOTAL (10 years' lifetime):	16.9kg CO_2 eq./m^2
CO_2 compensation	Carbon neutral Cool Carpet® is optional	
Manufacturing		
Location	Shelf, UK Factory is certified ISO 14001 since 1996 and ISO 9001 since 1986	
Installation Impacts		
TacTiles	Optimised for glue-free installation with TacTiles connectors with virtually zero VOCs	
Installation Waste	In a typical installation* using the installation method below: Quarter Turn – 3-4% installation waste Brick – 3-5% installation waste For reference: 2 metre wide broadloom typically generates 7-10 % installation waste ** In a rectangular building, installed before walls.*	
End-of-life		
Alternatives to landfill	Reuse: Can be cleaned and reused in a non-critical location to extend its useful life Recycling: Can be returned through the InterfaceFLOR ReEntry scheme and be re-used as raw material in new carpet tiles Waste-to-Energy: Can be incinerated in appropriate waste to energy plant	
Indoor Air Quality		
GuT (Gemeinschaft umweltfreundlicher Teppichboden)	The product passes all requirements of GuT's testing criteria regarding hazardous substances, emissions and odour. Certificate no. 24340	
CRI (Carpet & Rug Institute)	Compliant to the requirements of the Green Label Plus programme.	
Compliance to Green Building Schemes		
BREEAM (UK and international)	BRE Green Guide Ratings (according to 2008 scheme - please note ratings are not comparable to 1999 scheme): Office – B rated, Education – B rated, Health Care – A rated, Retail (by fashion) – A+ rated Potential contribution to following categories and credits: VOCs – Adhesives and carpet Materials Specifications	
LEED (US and international)	Potential direct or indirect contribution to following categories and credits: Indoor Environmental Quality Credit 4.1 Low Emitting Materials: Adhesive & Sealants Credit 4.3 Low Emitting Materials: Carpet Systems Materials and Resources Credit 4.1 Recycled content Credit 5.1 Regional Materials Credit 2.1 Construction Waste Management	
HQE (FR)	Potential direct or indirect contribution to several points within following targets: 2. Integrated choice of products and construction materials 3. Low site nuisance 5. Management of water 9. Acoustic comfort 10. Visual comfort 11. No unpleasant smells 12. Sanitary quality of areas 13. Sanitary air quality	
DGNB (D)	Potential direct or indirect contribution to following criterion Criterion 06 - Risks for the local environment Criterion 16 - Life-cycle costs related to the building Criterion 20 - Indoor hygiene Criterion 21 - Acoustic comfort Criterion 28 - Conversion ability Criterion 40 - Ease of cleaning and maintenance of the structure Criterion 42 - Deconstruction, recycling friendliness, friendliness of disassembly	
Type III Environmental Declaration		
EPD according to ISO 14025	This product has a type III generic Environmental Product Declaration, no. EPD-GUT-2009411-D The full EPD can be obtained at www.bau-umwelt.com under floor coverings	

THIS DATA CAN BE USED TO COMPARE CARPET PRODUCTS WITHIN THE INTERFACEFLOR PORTFOLIO. COMPARISON WITH OTHER PRODUCTS WOULD REQUIRE USE OF SAME METHODOLOGIES

Fastforward

Environmental Data Sheet

Recycled Content		
Overall Recycled Content	47.1% Pre-Consumer recycled content out of total weight	
Yarn system	100% BCF Solution Dyed Nylon PA 6,6 24.1% Pre-Consumer recycled content in the yarn on average Ranges from 22.1% to 26.6% subject to differences between colours	
Backing system	Graphlex® 63.6% of Pre-Consumer recycled content in the backing	
Carbon Footprint		
Estimated full life-cycle carbon footprint (using standardised method developed by GUT)	Raw materials and Production:	6.3kg CO_2 eq./m^2
	Delivery and installation:	0.4kg CO_2 eq./m^2
	Use (1 year):	0.2kg CO_2 eq./m^2
	End of life (waste to energy):	4.6kg CO_2 eq./m^2
	TOTAL (10 years' lifetime):	13.3kg CO_2 eq./m^2
CO_2 compensation	Carbon neutral Cool Carpet® is standard	
Manufacturing		
Location	Scherpenzeel, NL Factory is certified ISO 14001 since 1996 and ISO 9001 since 1990	
Installation Impacts		
TacTiles	Optimised for glue-free installation with TacTiles connectors with virtually zero VOCs	
Installation Waste	In a typical installation* using the installation method below: Non-directional – 1-2% installation waste Ashlar/Brick - 3-5% installation waste For reference: 2 metre wide broadloom typically generates 7-10 % installation waste * *In a rectangular building, installed before walls.*	
End-of-life		
Alternatives to landfill	Reuse: Can be cleaned and reused in a non-critical location to extend its useful life Recycling: Can be returned through the InterfaceFLOR ReEntry scheme and be re-used as raw material in new carpet tiles Waste-to-Energy: Can be incinerated in appropriate waste to energy plant	
Indoor Air Quality		
GuT (Gemeinschaft umweltfreundlicher Teppichboden)	The product passes all requirements of GuT's testing criteria regarding hazardous substances, emissions and odour. Certificate no. 23865	
CRI (Carpet & Rug Institute)	Compliant to the requirements of the Green Label Plus programme.	
Compliance to Green Building Schemes		
BREEAM (UK and international)	BRE Green Guide Ratings (according to 2008 scheme - please note ratings are not comparable to 1999 scheme): Office – A rated, Education – A rated, Health Care – A rated, Retail (by fashion) – A+ rated Potential contribution to following categories and credits: VOCs – Adhesives and carpet Materials Specifications	
LEED (US and international)	Potential direct or indirect contribution to following categories and credits: Indoor Environmental Quality Credit 4.1 Low Emitting Materials: Adhesive & Sealants Credit 4.3 Low Emitting Materials: Carpet Systems Materials and Resources Credit 4.1 Recycled content Credit 5.1 Regional Materials Credit 2.1 Construction Waste Management Innovation and Design Credit 1 Climate Neutral Products	
HQE (FR)	Potential direct or indirect contribution to several points within following targets: 2. Integrated choice of products and construction materials 3. Low site nuisance 5. Management of water 9. Acoustic comfort 10. Visual comfort 11. No unpleasant smells 12. Sanitary quality of areas 13. Sanitary air quality	
DGNB (D)	Potential direct or indirect contribution to following criterion Criterion 06 - Risks for the local environment Criterion 16 - Life-cycle costs related to the building Criterion 20 - Indoor hygiene Criterion 21 - Acoustic comfort Criterion 28 - Conversion ability Criterion 40 - Ease of cleaning and maintenance of the structure Criterion 42 - Deconstruction, recycling friendliness, friendliness of disassembly	
Type III Environmental Declaration		
EPD according to ISO 14025	This product has a type III generic Environmental Product Declaration, no. EPD-GUT-2009411-D The full EPD can be obtained at www.bau-umwelt.com under floor coverings	

THIS DATA CAN BE USED TO COMPARE CARPET PRODUCTS WITHIN THE INTERFACEFLOR PORTFOLIO. COMPARISON WITH OTHER PRODUCTS WOULD REQUIRE USE OF SAME METHODOLOGIES

Lima

Recycled Content		
Overall Recycled Content	19.3% Pre-Consumer recycled content out of total weight	
Yarn system	100% BCF Solution Dyed Nylon PA 6,6 22.9% Pre-Consumer recycled content in the yarn on average Ranges from 21.2% to 25.4% subject to differences between colours	
Backing system	Graphlex® 22.4% of Pre-Consumer recycled content in the backing	
Carbon Footprint		
Estimated full life-cycle carbon footprint (using standardised method developed by GUT)	Raw materials and Production:	8.1kg CO_2 eq./m^2
	Delivery and installation:	0.4kg CO_2 eq./m^2
	Use (1 year):	0.2kg CO_2 eq./m^2
	End of life (waste to energy):	4.8kg CO_2 eq./m^2
	TOTAL (10 years' lifetime):	15.3kg CO_2 eq./m^2
CO_2 compensation	Carbon neutral Cool Carpet® is optional	
Manufacturing		
Location	Scherpenzeel, NL & Shelf, UK Factories are certified ISO 14001 - UK 1996 / NL 1996 and ISO 9001 - UK 1986 / NL 1990	
Installation Impacts		
TacTiles	Optimised for glue-free installation with TacTiles connectors with virtually zero VOCs	
Installation Waste	In a typical installation* using the installation method below: Quarter Turn – 3-4% installation waste Ashlar – 3-5% installation waste For reference: 2 metre wide broadloom typically generates 7-10 % installation waste ** In a rectangular building, installed before walls.*	
End-of-life		
Alternatives to landfill	Reuse: Can be cleaned and reused in a non-critical location to extend its useful life Recycling: Can be returned through the InterfaceFLOR ReEntry scheme and be re-used as raw material in new carpet tiles Waste-to-Energy: Can be incinerated in appropriate waste to energy plant	
Indoor Air Quality		
GuT (Gemeinschaft umweltfreundlicher Teppichboden)	The product passes all requirements of GuT's testing criteria regarding hazardous substances, emissions and odour. Certificate no. 24126	
CRI (Carpet & Rug Institute)	Compliant to the requirements of the Green Label Plus programme.	
Compliance to Green Building Schemes		
BREEAM (UK and international)	BRE Green Guide Ratings (according to 2008 scheme - please note ratings are not comparable to 1999 scheme): Office – A rated, Education – A rated, Health Care – A rated, Retail (by fashion) – A+ rated Potential contribution to following categories and credits: VOCs – Adhesives and carpet Materials Specifications	
LEED (US and international)	Potential direct or indirect contribution to following categories and credits: Indoor Environmental Quality Credit 4.1 Low Emitting Materials: Adhesive & Sealants Credit 4.3 Low Emitting Materials: Carpet Systems Materials and Resources Credit 4.1 Recycled content Credit 5.1 Regional Materials Credit 2.1 Construction Waste Management	
HQE (FR)	Potential direct or indirect contribution to several points within following targets: 2. Integrated choice of products and construction materials 3. Low site nuisance 5. Management of water 9. Acoustic comfort 10. Visual comfort 11. No unpleasant smells 12. Sanitary quality of areas 13. Sanitary air quality	
DGNB (D)	Potential direct or indirect contribution to following criterion Criterion 06 - Risks for the local environment Criterion 16 - Life-cycle costs related to the building Criterion 20 - Indoor hygiene Criterion 21 - Acoustic comfort Criterion 28 - Conversion ability Criterion 40 - Ease of cleaning and maintenance of the structure Criterion 42 - Deconstruction, recycling friendliness, friendliness of disassembly	
Type III Environmental Declaration		
EPD according to ISO 14025	This product has a type III generic Environmental Product Declaration, no. EPD-GUT-2009411-E The full EPD can be obtained at www.bau-umwelt.com under floor coverings	

THIS DATA CAN BE USED TO COMPARE CARPET PRODUCTS WITHIN THE INTERFACEFLOR PORTFOLIO. COMPARISON WITH OTHER PRODUCTS WOULD REQUIRE USE OF SAME METHODOLOGIES

Environmental Data Sheet

Palette 2000

Recycled Content		
Overall Recycled Content	4.8% Pre-Consumer recycled content out of total weight	
Yarn system	100% Nylon PA 6,6 25.0% Pre-Consumer recycled content in the yarn on average Ranges from 25.0% to 25.0% subject to differences between colours	
Backing system	GlasBac® 0.0% of Pre-Consumer recycled content in the backing	
Carbon Footprint		
Estimated full life-cycle carbon footprint (using standardised method developed by GUT)	Raw materials and Production:	13.6kg CO_2 eq./m^2
	Delivery and installation:	0.5kg CO_2 eq./m^2
	Use (1 year):	0.2kg CO_2 eq./m^2
	End of life (waste to energy):	5.1kg CO_2 eq./m^2
	TOTAL (10 years' lifetime):	21.2kg CO_2 eq./m^2
CO_2 compensation	Carbon neutral Cool Carpet® is optional	
Manufacturing		
Location	Shelf, UK Factory is certified ISO 14001 since 1996 and ISO 9001 since 1986	
Installation Impacts		
TacTiles	Optimised for glue-free installation with TacTiles connectors with virtually zero VOCs	
Installation Waste	In a typical installation* using the installation method below: Monolithic – 3-4% installation waste For reference: 2 metre wide broadloom typically generates 7-10 % installation waste ** In a rectangular building, installed before walls.*	
End-of-life		
Alternatives to landfill	Reuse: Can be cleaned and reused in a non-critical location to extend its useful life Recycling: Can be returned through the InterfaceFLOR ReEntry scheme and be re-used as raw material in new carpet tiles Waste-to-Energy: Can be incinerated in appropriate waste to energy plant	
Indoor Air Quality		
GuT (Gemeinschaft umweltfreundlicher Teppichboden)	The product passes all requirements of GuT's testing criteria regarding hazardous substances, emissions and odour. Certificate no. 14330	
CRI (Carpet & Rug Institute)	Compliant to the requirements of the Green Label Plus programme.	
Compliance to Green Building Schemes		
BREEAM (UK and international)	BRE Green Guide Ratings (according to 2008 scheme - please note ratings are not comparable to 1999 scheme): Office – B rated, Education – B rated, Health Care – B rated, Retail (by fashion) – A rated Potential contribution to following categories and credits: VOCs – Adhesives and carpet Materials Specifications	
LEED (US and international)	Potential direct or indirect contribution to following categories and credits: Indoor Environmental Quality Credit 4.1 Low Emitting Materials: Adhesive & Sealants Credit 4.3 Low Emitting Materials: Carpet Systems Materials and Resources Credit 4.1 Recycled content Credit 5.1 Regional Materials Credit 2.1 Construction Waste Management	
HQE (FR)	Potential direct or indirect contribution to several points within following targets: 2. Integrated choice of products and construction materials 3. Low site nuisance 5. Management of water 9. Acoustic comfort 10. Visual comfort 11. No unpleasant smells 12. Sanitary quality of areas 13. Sanitary air quality	
DGNB (D)	Potential direct or indirect contribution to following criterion Criterion 06 - Risks for the local environment Criterion 16 - Life-cycle costs related to the building Criterion 20 - Indoor hygiene Criterion 21 - Acoustic comfort Criterion 28 - Conversion ability Criterion 40 - Ease of cleaning and maintenance of the structure Criterion 42 - Deconstruction, recycling friendliness, friendliness of disassembly	

Environmental Data Sheet

Scandinavian Collection

Recycled Content		
Overall Recycled Content	50.2% Pre-Consumer recycled content out of total weight	
Yarn system	100% BCF solution dyed nylon PA 6,6 32.0% Pre-Consumer recycled content in the yarn on average Ranges from 30.6% to 33.2% subject to differences between colours	
Backing system	Graphlex® 67% of Pre-Consumer recycled content in the backing	
Carbon Footprint		
Estimated full life-cycle carbon footprint (using standardised method developed by GUT)	Raw materials and Production:	6.9kg CO_2 eq./m^2
	Delivery and installation:	0.4kg CO_2 eq./m^2
	Use (1 year):	0.2kg CO_2 eq./m^2
	End of life (waste to energy):	4.4kg CO_2 eq./m^2
	TOTAL (10 years' lifetime):	13.7kg CO_2 eq./m^2
CO_2 compensation	Carbon neutral Cool Carpet® is standard	
Manufacturing		
Location	Scherpenzeel, NL Factory is certified ISO 14001 since 1996 and ISO 9001 since 1990	
Installation Impacts		
TacTiles	Optimised for glue-free installation with TacTiles connectors with virtually zero VOCs	
Installation Waste	In a typical installation* using the installation method below: Quarter Turn – 3-4% installation waste For reference: 2 metre wide broadloom typically generates 7-10 % installation waste * *In a rectangular building, installed before walls.*	
End-of-life		
Alternatives to landfill	Reuse: Can be cleaned and reused in a non-critical location to extend its useful life Recycling: Can be returned through the InterfaceFLOR ReEntry scheme and be re-used as raw material in new carpet tiles Waste-to-Energy: Can be incinerated in appropriate waste to energy plant	
Indoor Air Quality		
GuT (Gemeinschaft umweltfreundlicher Teppichboden)	The product passes all requirements of GuT's testing criteria regarding hazardous substances, emissions and odour. Certificate no. 23244	
CRI (Carpet & Rug Institute)	Compliant to the requirements of the Green Label Plus programme.	
Compliance to Green Building Schemes		
BREEAM (UK and international)	BRE Green Guide Ratings (according to 2008 scheme - please note ratings are not comparable to 1999 scheme): Office – A rated, Education – A rated, Health Care – A rated, Retail (by fashion) – A+ rated Potential contribution to following categories and credits: VOCs – Adhesives and carpet Materials Specifications	
LEED (US and international)	Potential direct or indirect contribution to following categories and credits: Indoor Environmental Quality Credit 4.1 Low Emitting Materials: Adhesive & Sealants Credit 4.3 Low Emitting Materials: Carpet Systems Materials and Resources Credit 4.1 Recycled content Credit 5.1 Regional Materials Credit 2.1 Construction Waste Management Innovation and Design Credit 1 Climate Neutral Products	
HQE (FR)	Potential direct or indirect contribution to several points within following targets: 2. Integrated choice of products and construction materials 3. Low site nuisance 5. Management of water 9. Acoustic comfort 10. Visual comfort 11. No unpleasant smells 12. Sanitary quality of areas 13. Sanitary air quality	
DGNB (D)	Potential direct or indirect contribution to following criterion Criterion 06 - Risks for the local environment Criterion 16 - Life-cycle costs related to the building Criterion 20 - Indoor hygiene Criterion 21 - Acoustic comfort Criterion 28 - Conversion ability Criterion 40 - Ease of cleaning and maintenance of the structure Criterion 42 - Deconstruction, recycling friendliness, friendliness of disassembly	
Type III Environmental Declaration		
EPD according to ISO 14025	This product has a type III Environmental Product Declaration, no. EPD-IFF-2010111-E. The full EPD can be obtained at www.bau-umwelt.com under floor coverings	

THIS DATA CAN BE USED TO COMPARE CARPET PRODUCTS WITHIN THE INTERFACEFLOR PORTFOLIO. COMPARISON WITH OTHER PRODUCTS WOULD REQUIRE USE OF SAME METHODOLOGIES

X-Loop

Recycled Content		
Overall Recycled Content	28.7% Pre-Consumer recycled content out of total weight	
Yarn system	100% BCF Nylon PA 6 0.0% Pre-Consumer recycled content in the yarn on average	
Backing system	Graphlex® 63.6% of Pre-Consumer recycled content in the backing	
Carbon Footprint		
Estimated full life-cycle carbon footprint (using standardised method developed by GUT)	Raw materials and Production:	12.0kg CO_2 eq./m^2
	Delivery and installation:	0.4kg CO_2 eq./m^2
	Use (1 year):	0.2kg CO_2 eq./m^2
	End of life (waste to energy):	4.8kg CO_2 eq./m^2
	TOTAL (10 years' lifetime):	19.2kg CO_2 eq./m^2
CO_2 compensation	Carbon neutral Cool Carpet® is optional	
Manufacturing		
Location	Scherpenzeel, NL Factory is certified ISO 14001 since 1996 and ISO 9001 since 1990	
Installation Impacts		
TacTiles	Optimised for glue-free installation with TacTiles connectors with virtually zero VOCs	
Installation Waste	In a typical installation* using the installation method below: Monolithic – 3-4% installation waste For reference: 2 metre wide broadloom typically generates 7-10 % installation waste * *In a rectangular building, installed before walls.*	
End-of-life		
Alternatives to landfill	Reuse: Can be cleaned and reused in a non-critical location to extend its useful life Recycling: Can be returned through the InterfaceFLOR ReEntry scheme and be re-used as raw material in new carpet tiles Waste-to-Energy: Can be incinerated in appropriate waste to energy plant	
Indoor Air Quality		
GuT (Gemeinschaft umweltfreundlicher Teppichboden)	The product passes all requirements of GuT's testing criteria regarding hazardous substances, emissions and odour. Certificate no. 24406	
CRI (Carpet & Rug Institute)	Compliant to the requirements of the Green Label Plus programme.	
Compliance to Green Building Schemes		
BREEAM (UK and international)	Potential contribution to following categories and credits: VOCs – Adhesives and carpet Materials Specifications	
LEED (US and international)	Potential direct or indirect contribution to following categories and credits: Indoor Environmental Quality Credit 4.1 Low Emitting Materials: Adhesive & Sealants Credit 4.3 Low Emitting Materials: Carpet Systems Materials and Resources Credit 4.1 Recycled content Credit 5.1 Regional Materials Credit 2.1 Construction Waste Management	
HQE (FR)	Potential direct or indirect contribution to several points within following targets: 2. Integrated choice of products and construction materials 3. Low site nuisance 5. Management of water 9. Acoustic comfort 10. Visual comfort 11. No unpleasant smells 12. Sanitary quality of areas 13. Sanitary air quality	
DGNB (D)	Potential direct or indirect contribution to following criterion Criterion 06 - Risks for the local environment Criterion 16 - Life-cycle costs related to the building Criterion 20 - Indoor hygiene Criterion 21 - Acoustic comfort Criterion 28 - Conversion ability Criterion 40 - Ease of cleaning and maintenance of the structure Criterion 42 - Deconstruction, recycling friendliness, friendliness of disassembly	
Type III Environmental Declaration		
EPD according to ISO 14025	This product has a type III generic Environmental Product Declaration, no. EPD-GUT-2009111-E The full EPD can be obtained at www.bau-umwelt.com under floor coverings	