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THROUGH: Mary Ann Danello, Ph.D., Associate Executive Director, Directorate for Health Sciences

FROM: Kent R. Carlson, Ph.D., Toxicologist, Directorate for Health Sciences

SUBJECT: U.S. CPSC Staff Assessment of Phthalate Dietary Exposure Using Two Food Residue Datasets and Three Food Categorization Schemes

The following memo provides the U.S. Consumer Product Safety Commission’s (CPSC’s) Health Sciences staff assessment of the dietary exposure to various phthalates. The information in this report will be provided to the Chronic Hazard Advisory Panel (CHAP) on Phthalates.

A detailed dietary exposure assessment was requested by the CHAP in order to evaluate the relationship of dietary phthalate exposure to total phthalate exposure.

* These comments are those of the CPSC staff, have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

† Leslie E. Patton, Ph.D., Toxicologist, who is no longer with CPSC, contributed to this report.
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<th>Description</th>
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<tbody>
<tr>
<td>3β-HSD</td>
<td>3β-hydroxysteroid dehydrogenase</td>
</tr>
<tr>
<td>AA</td>
<td>antiandrogenicity; antiandrogenic</td>
</tr>
<tr>
<td>ADHD</td>
<td>attention deficit hyperactivity disorder</td>
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<tr>
<td>ADI</td>
<td>acceptable daily intake</td>
</tr>
<tr>
<td>AGD</td>
<td>anogenital distance</td>
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<td>AGI</td>
<td>anogenital index</td>
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<td>ASD</td>
<td>Autistic Spectrum Disorders</td>
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<td>ASTDR</td>
<td>Agency for Toxic Substances and Disease Registry</td>
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<tr>
<td>ATBC</td>
<td>acetyl tributyl citrate</td>
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<tr>
<td>BASC-PRS</td>
<td>Behavior Assessment System for Children-Parent Rating Scales</td>
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<td>BBP</td>
<td>butylbenzyl phthalate</td>
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<td>BIBRA</td>
<td>British Industrial Biological Research Association</td>
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<tr>
<td>BMD</td>
<td>benchmark dose</td>
</tr>
<tr>
<td>BMDL</td>
<td>benchmark dose (lower confidence limit)</td>
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<tr>
<td>BNBA</td>
<td>Brazelton Neonatal Behavioral Assessment</td>
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<td>BRIEF</td>
<td>Behavior Rating Inventory of Executive Function</td>
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<td>behavioral symptoms index</td>
</tr>
<tr>
<td>CBCL</td>
<td>Child Behavior Check List</td>
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<td>Consumer Product Safety Commission, U.S.</td>
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<td>Consumer Product Safety Improvement Act of 2008</td>
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<td>CRA</td>
<td>cumulative risk assessment</td>
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<tr>
<td>CSL</td>
<td>cranial suspensory ligament</td>
</tr>
<tr>
<td>cx-MIDP</td>
<td>mono(carboxy-isononyl) phthalate (also, CNP, MCNP)</td>
</tr>
<tr>
<td>cx-MINP</td>
<td>mono(carboxy-isooctyl) phthalate (also COP, MCOP)</td>
</tr>
<tr>
<td>DAP</td>
<td>diallyl phthalate</td>
</tr>
<tr>
<td>DBP</td>
<td>dibutyl phthalate</td>
</tr>
<tr>
<td>DCHP</td>
<td>dicyclohexyl phthalate</td>
</tr>
<tr>
<td>DDP</td>
<td>di-(n)-decyl phthalate</td>
</tr>
<tr>
<td>DEHA</td>
<td>di(2-ethylhexyl) adipate</td>
</tr>
<tr>
<td>DEHP</td>
<td>di(2-ethylhexyl) phthalate</td>
</tr>
<tr>
<td>DEHT</td>
<td>di(2-ethylhexyl) terephthalate</td>
</tr>
<tr>
<td>DEP</td>
<td>diethyl phthalate</td>
</tr>
<tr>
<td>DHEPP</td>
<td>di-(n)-heptyl phthalate</td>
</tr>
<tr>
<td>DHEXP</td>
<td>di-(n)-hexyl phthalate</td>
</tr>
<tr>
<td>DHT</td>
<td>dihydrotestosterone</td>
</tr>
</tbody>
</table>

* List applies to main report and all appendices.
DI daily intake
DIBP diisobutyl phthalate
DIDP diisodecyl phthalate
DIHEPP diisohexyl phthalate
DIHEXP diisoheptyl phthalate
DINP diisononyl phthalate
DINCH® 1,2-cyclohexanedicarboxylic acid, diisononyl ester
DINX 1,2-cyclohexanedicarboxylic acid, diisononyl ester
DIOP diisooctyl phthalate
DIPP diisopropyl phthalate
DMP dimethyl phthalate
DNHEXP di-\(n\)-hexyl phthalate
DNOP di-\(n\)-octyl phthalate
DOTP di(2-ethylhexyl) terephthalate
DPENP di-\(n\)-pentyl phthalate
DPHP di(2-propylheptyl) phthalate
DPS delayed preputial separation
DSP decrease spermatocytes and spermatids
DVO delayed vaginal opening
ECHA European Chemicals Agency
ECMO extracorporeal membrane oxygenation
ED\(_{50}\) median effective dose
EPA Environmental Protection Agency, U.S.
EPW epididymal weight
FDA Food and Drug Administration, U.S.
f\(_{\text{ue}}\) urinary excretion factor
GD gestational day
GGT gamma-glutamyl transferase
GLP good laboratory practices
grn granulin
HBM human biomonitoring
hCG human chorionic gonadotrophin
HI hazard index
HMW high molecular weight
HPV high production volume
HQ hazard quotient
IARC International Agency for Research on Cancer
ICH International Conference on Harmonisation
insl3 insulin-like factor 3
IP intraperitoneally
JRC Joint Research Centre
LD lactation day
LH luteinizing hormone
LMW low molecular weight
LOAEL lowest observed adverse effect level
LOD level/limit of detection
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOQ</td>
<td>level/limit of quantitation</td>
</tr>
<tr>
<td>MBP</td>
<td>monobutyl phthalate</td>
</tr>
<tr>
<td>MBZP</td>
<td>monobenzyl phthalate</td>
</tr>
<tr>
<td>MCPP</td>
<td>mono(3-carboxypropyl) phthalate</td>
</tr>
<tr>
<td>MDI</td>
<td>mental development index</td>
</tr>
<tr>
<td>MECPP</td>
<td>mono(2-ethyl-5-carboxypentyl) phthalate</td>
</tr>
<tr>
<td>MEHP</td>
<td>mono(2-ethylhexyl) phthalate</td>
</tr>
<tr>
<td>MEHHP</td>
<td>mono(2-ethyl-5-hydroxyhexyl) phthalate</td>
</tr>
<tr>
<td>MEOHP</td>
<td>mono(2-ethyl-5-oxohexyl) phthalate</td>
</tr>
<tr>
<td>MEP</td>
<td>monoethyl phthalate</td>
</tr>
<tr>
<td>MIBP</td>
<td>monoisobutyl phthalate</td>
</tr>
<tr>
<td>MINP</td>
<td>mono(isononyl) phthalate</td>
</tr>
<tr>
<td>MIS</td>
<td>Mullerian inhibiting substance</td>
</tr>
<tr>
<td>MMP</td>
<td>monomethyl phthalate</td>
</tr>
<tr>
<td>MNG</td>
<td>multinucleated gonocyte</td>
</tr>
<tr>
<td>MNOP</td>
<td>mono-(n)-octyl phthalate</td>
</tr>
<tr>
<td>MOE</td>
<td>margin of exposure</td>
</tr>
<tr>
<td>MSSM</td>
<td>Mount Sinai School of Medicine</td>
</tr>
<tr>
<td>MW</td>
<td>molecular weight</td>
</tr>
<tr>
<td>NA</td>
<td>not available</td>
</tr>
<tr>
<td>NAE</td>
<td>no antiandrogenic effects observed</td>
</tr>
<tr>
<td>NCEA</td>
<td>National Center for Environmental Assessment</td>
</tr>
<tr>
<td>NHANES</td>
<td>National Health and Nutritional Examination Survey</td>
</tr>
<tr>
<td>NNNS</td>
<td>NICU Network Neurobehavioral Scale</td>
</tr>
<tr>
<td>NOAEL</td>
<td>no observed adverse effect level</td>
</tr>
<tr>
<td>NOEL</td>
<td>no observed effect level</td>
</tr>
<tr>
<td>NR</td>
<td>nipple retention</td>
</tr>
<tr>
<td>NRC</td>
<td>National Research Council, U.S.</td>
</tr>
<tr>
<td>NTP</td>
<td>National Toxicology Program, U.S.</td>
</tr>
<tr>
<td>OECD</td>
<td>Organisation for Economic Cooperation and Development</td>
</tr>
<tr>
<td>OH-MIDP</td>
<td>mono(hydroxy-isodecyl) phthalate</td>
</tr>
<tr>
<td>OH-MINP</td>
<td>mono(hydroxy-isononyl) phthalate</td>
</tr>
<tr>
<td>OR</td>
<td>odds ratio</td>
</tr>
<tr>
<td>oxo-MIDP</td>
<td>mono(oxo-isodecyl) phthalate</td>
</tr>
<tr>
<td>oxo-MINP</td>
<td>mono(oxo-isononyl) phthalate</td>
</tr>
<tr>
<td>PBR</td>
<td>peripheral benzodiazepine receptor</td>
</tr>
<tr>
<td>PDI</td>
<td>psychomotor developmental index</td>
</tr>
<tr>
<td>PE</td>
<td>phthalate ester</td>
</tr>
<tr>
<td>PEAAA</td>
<td>potency estimates for antiandrogenicity</td>
</tr>
<tr>
<td>PND</td>
<td>postnatal day</td>
</tr>
<tr>
<td>PNW</td>
<td>postnatal week</td>
</tr>
<tr>
<td>POD</td>
<td>point of departure</td>
</tr>
<tr>
<td>PODI</td>
<td>point of departure index</td>
</tr>
<tr>
<td>PPARα</td>
<td>peroxisome proliferator-activated receptor alpha</td>
</tr>
<tr>
<td>PPS</td>
<td>probability proportional to a measure of size</td>
</tr>
<tr>
<td>PSU</td>
<td>primary sampling unit</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>PVC</td>
<td>polyvinyl chloride</td>
</tr>
<tr>
<td>RfD</td>
<td>reference dose</td>
</tr>
<tr>
<td>RTM</td>
<td>reproductive tract malformation</td>
</tr>
<tr>
<td>SD</td>
<td>Sprague-Dawley</td>
</tr>
<tr>
<td>SDN-POA</td>
<td>sexually dimorphic nucleus of the preoptic area</td>
</tr>
<tr>
<td>SFF</td>
<td>Study for Future Families</td>
</tr>
<tr>
<td>SR-B1</td>
<td>scavenger receptor class B1</td>
</tr>
<tr>
<td>SRS</td>
<td>social responsiveness scale</td>
</tr>
<tr>
<td>StAR</td>
<td>steroidogenic acute regulatory protein</td>
</tr>
<tr>
<td>SVW</td>
<td>seminal vesicle weight</td>
</tr>
<tr>
<td>TCDD</td>
<td>2,3,7,8-tetrachlorodibenzo-p-dioxin</td>
</tr>
<tr>
<td>TDI</td>
<td>tolerable daily intake</td>
</tr>
<tr>
<td>TDS</td>
<td>testicular dysgenesis syndrome</td>
</tr>
<tr>
<td>TEF</td>
<td>toxicity equivalency factors</td>
</tr>
<tr>
<td>TOTM</td>
<td>tris(2-ethylhexyl) trimellitate</td>
</tr>
<tr>
<td>TPIB</td>
<td>2,2,4-trimethyl-1,3 pentanediol diisobutyrate</td>
</tr>
<tr>
<td>T PROD</td>
<td>testosterone production</td>
</tr>
<tr>
<td>TXIB®</td>
<td>2,2,4-trimethyl-1,3 pentanediol diisobutyrate</td>
</tr>
<tr>
<td>UF</td>
<td>uncertainty factor</td>
</tr>
</tbody>
</table>
1 Introduction

The Consumer Product Safety Improvement Act (CPSIA)* of (2008) was enacted on August 14, 2008. Section 108 of the CPSIA permanently prohibits the sale of any “children’s toy or child care article” containing concentrations of more than 0.1 percent of dibutyl phthalate (DBP), butylbenzyl phthalate (BBP), or di(2-ethylhexyl) phthalate (DEHP). Section 108 prohibits on an interim basis the sale of “any children’s toy that can be placed in a child’s mouth” or “child care article” containing concentrations of more than 0.1 percent of di-n-octyl phthalate (DNOP), diisononyl phthalate (DINP), or diisodecyl phthalate (DIDP). In addition, Section 108 of the CPSIA directs Consumer Product Safety Commission (CPSC) to convene a Chronic Health Advisory Panel (CHAP) “to study the effects on children’s health of all phthalates and phthalate alternatives as used in children’s toys and child care articles.” The CHAP will recommend to the Commission whether any phthalates (including DINP) or phthalate alternatives other than those permanently banned should be declared banned hazardous substances.

In order to fulfill part of this charge, the CHAP is considering exposure to phthalates from all routes, including the diet (food). The CHAP has requested that CPSC staff utilize phthalate residues in food items (as reported in the published literature) to calculate dietary exposure to phthalate residues.

In this memo, the CPSC staff have provided analyses for seven target populations of interest (infants, toddlers, children, teen females, teen males, adult females, adult males). For each one, the following information has been provided in either numeric or graphical constructs:

1) Total average and 95th percentile dietary exposure (organized by phthalate for the UK food item/residue dataset);
2) Total average and 95th percentile dietary exposure (organized by phthalate for the P&L food item/residue dataset);
3) The relative change in exposure (percent of #1 and #2) when some food items are removed from the analysis;
4) The relative contribution of each phthalate to the total exposure from diet (using different food categorization schemes and food item/residue datasets); and
5) The relative contribution of each phthalate to exposure for each food category (i.e., breads, meats, etc; using different food categorization schemes and food item/residue datasets).

* Public Law 110-314.
2 Methods

2.1 Food Item Phthalate Residues: Bradley, Page and LaCroix

CPSC staff utilized two datasets of phthalate residues in food items (Page and Lacroix, 1995; Bradley, 2011) to calculate potential phthalate exposures that result from food consumption. Exposures calculated from both datasets are presented for the CHAP’s consideration.

2.1.1 Bradley, 2011 (UK)

The Bradley (2011) dataset (hereafter referred to as the UK study) is a total diet study carried out in the United Kingdom and contains the most recently reported food residue data that CPSC staff could identify. In the study, 261 retail food items were analyzed for 15 phthalate diesters (dimethyl phthalate [DMP], diethyl phthalate [DEP], diisopropyl phthalate [DIPP], diallyl phthalate [DAP], diisobutyl phthalate [DIBP], DBP, di-\(n\)-pentyl phthalate [DPP], di-\(n\)-hexyl phthalate [DHEXP], BBP, dicyclohexyl phthalate [DCHP], DEHP, DNOP, DINP, DIDP, and di-\(n\)-decyl phthalate [DDP]). Nine phthalate monoesters and phthalic acid were also determined in food items. Distinct food items in this study were categorized as bread products, dairy products, fish and fish products, infant food, infant formula, meat and meat products, miscellaneous cereal products, oils and fat products, liver products, or eggs. Consumption estimates for these food categories were not provided, however.

2.1.2 Page and LaCroix, 1995 (P&L)

The dataset in Page and LaCroix (1995) analyzed phthalate residues in a wide variety of foods, making the data useful despite their age. The P&L study analyzed 98 food items for DEP, BBP, DBP, and DEHP, as well as the nonphthalate plasticizer diethylhexyl adipate (DEHA). The food they analyzed was primarily packaged and fell into the following general categories: cheese, meat, fish, frozen foods (meat, fish, poultry), beverages (soda, juice, bottled water, wine), fruits and vegetables, oil and fat, bread, dairy, and infant food. As with the UK dataset, consumption estimates were not published for these particular food categories.

2.2 Food Categorization and Consumption Estimates: NCEA, Clark, Wormuth

CPSC staff recombined food items from both food item/residue datasets into alternate food categories that had published consumption estimates (see Table ES-5 and Section 4.1). Unknown food items were researched online in order to bin them into the “correct” food categories.

2.2.1 NCEA, 2007

The first and simplest food categorization scheme was based on the food groups used by U.S. EPA National Center for Environmental Assessment ([NCEA], 2007) in the publication Analysis of Total Food Intake and Composition of Individual’s Diet Based on USDA’s 1994–1996, 1998 Continuing Survey of Food Intakes by Individuals (CSFII). In this reference, food was divided into the following (total) categories: grain, dairy, fish, meat, fat, vegetable, fruit, soy, nut, and eggs.


2.2.2Clark et al., 2011

The second categorization scheme, intermediate in complexity, was retrieved from Clark et al. (2011). This paper categorized food as tap water, beverages, cereals, dairy products (excluding milk), eggs, fats/oils, fish, fruits, grains, meats, milk, nuts and beans, other foods, poultry, processed meats, vegetables, infant formula (powder), or breast milk.

2.2.3Wormuth et al., 2006

The third, and most complex, food categorization scheme was taken from a 2006 publication by Wormuth et al. (2006). The authors in this study categorized food into the following groups: pasta/rice, cereals, breakfast cereals, bread, biscuits/crispy bread, cakes/buns/puddings, bakeries/snacks, milk/milk beverages, cream, ice cream, yogurt, cheese, eggs, spreads, animal fats, vegetable oils, meat/meat products, sausage, poultry, fish, vegetables, potatoes, fruits, nuts/nut spreads, preserves/sugar, confectionary, spices, soups/sauces, juices, tea/coffee, soft drinks, beer, wine, spirits, tap water, bottled water, commercial infant food, infant formulas, and breast milk.

2.3Food Categories with No Food Items/Residues

Both the UK (2011) and P&L (1995) food item/residue datasets had gaps in the representation of available food commodities. These gaps in food or beverage coverage sometimes affected the number of food items per category in all categorization schemes.

A few of NCEA (2007) categories were not represented by food item/residue data. These included vegetable, fruit, soy, nut (UK dataset); and soy, nut (P&L dataset). As with NCEA groupings, a few of the Clark categories did not have food item/residue data. These included tap water, beverages, fruit, nuts and beans, vegetables, breast milk (UK dataset); tap water, nuts and beans, breast milk (P&L dataset). A few of Wormuth et al. (2006) categories were also not filled by food item/residue data. These were ice cream, vegetables, potatoes, fruits, nuts and nut spreads, preserves and sugar, confectionary, spices, soups and sauces, juices, tea and coffee, soft drinks, beer, wine, spirits, tap water, bottled water, breast milk (UK dataset); vegetable oils, spices, spirits, tap water, breast milk (P&L dataset). Even though the P&L dataset was comprised of fewer actual samples, representative category coverage was better than that provided by the UK dataset. Categories that were not represented by at least one food item were excluded from further analysis.

2.4Summary Statistics from Food Item/Residue Data

Prior to data summarization, all food items in both datasets with “nondetects” were assigned a value of one-half the Level of Detection (LOD) or one-half the Level of Quantification (LOQ), depending on which was reported. Replacing nondetects into one-half the LOD/LOQ is one method commonly initially employed in conservative dietary exposure assessments to ensure that the exposures are not underestimated (by using zeros for nondetects) or overestimated (biased high by a few reported residue values) (EPA, 2000). Replacement is justified when there is the expectation that residues are present, but below the LOD (e.g., a crop has been treated with a pesticide, but pesticide residues are not detected on the crop). This expectation holds for phthalates because they are ubiquitous in the environment and, therefore, ubiquitous in food commodities. Because of replacement, most categories were represented predominantly by one-
half the LOD or LOQ values. It is expected that the effects of replacement substantially affected
the summary residue values for many food categories that were comprised of fewer food items
(without doing a sensitivity analysis). Broader categorization schemes (e.g., EPA, 2007),
however, were expected to be less affected by the replacement of nondetects with one-half the
LOD/LOQ.

Residues that were “not confirmed” in the UK dataset were left as is and combined with
nondetects (one-half the LOD/LOQ), and detects. Many of these “not confirmed” residues had
concentrations that were similar to other reported residue concentrations within the same
category.

Ultimately, individual phthalate diester residues, including one-half LOD/LOQ values and values
listed as “not confirmed” were combined within each food category and reported as both the
average and 95th percentile. Monoester and phthalic acid residues in foods (conceivably created
by catalytic activity in the food) were not considered in this exposure assessment summarization.

2.5 Calculation of Phthalate Exposure Estimates from Food

2.5.1 Phthalate Concentration in Food

For each population and residue dataset, daily average dietary exposures (µg/kg-d) and daily 95th
percentile phthalate exposures (µg/kg-d) from the ingestion of food item f were calculated for
each individual phthalate ester i and summed:

\[
\text{Phthalate}_i \times \text{Concentration in Food}_f (\mu g/g) \times \text{Food Consumption}_f (g/day) \times \text{Absorption Factor}_f \times \text{Body Weight (kg)}
\]

2.5.2 Consumption Factors for Conversion to Per-Capita (eaters + non-eaters)

Dietary exposures using the Wormuth scheme of product categorization were also expressed
using a consumption factor (CF) to account for the fraction of the population eating the specific
food type. Consumption factors were obtained from the Wormuth et al. (2006) paper and applied
using the following equation:

\[
\text{Phthalate}_i \times \frac{\text{Concentration in Food}_f (\mu g/g) \times \text{Food Consumption}_f (g/day) \times \text{Absorption Factor}_f \times \text{CF}_f}{\text{Body Weight (kg)}}
\]

No CFs were available for the Clark food categorizations, and therefore, a CF of 1 was used.
This conservative assumption meant that 100% of the given population would consume a
specific food item. NCEA consumption estimates were already expressed as per-capita so did not
need the application of a CF.

2.5.3 Food Consumption

Population-based food consumption estimates specific to each of the seven populations of
interest were extracted from the three sources of food categories (U.S. EPA/NCEA, [2007];
Clark et al. [2003]; Wormuth et al. [2006]; see Table E3-1).
2.5.4 Phthalate Absorption

Phthalate absorption was considered separately in two manners, at 100% (1), and as a factor calculated from the mean oral uptake rate (i.e., the fraction of dose applied) derived from Wormuth et al. (2006). Both of these factors were unitless. When no information on absorption was identified for a specific phthalate, a value of 1 was used, indicating a conservative 100% absorption of the phthalate.

2.5.5 Body Weight

Body weight information used in exposure calculations was derived from each respective study (U.S. EPA/NCEA [2007]; Clark et al. [2011]; and Wormuth et al. [2006]). This information is summarized in Table E3-1 along with the associated age ranges for the populations.

Table E3-1 Population age and body weight used to calculate phthalate exposure.

<table>
<thead>
<tr>
<th>Population</th>
<th>Age in Years (M&amp;F combined)</th>
<th>Body Weights (kg; Gender)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>&lt;1</td>
<td>0–0.5</td>
</tr>
<tr>
<td>Toddler</td>
<td>1–5</td>
<td>0.5–4</td>
</tr>
<tr>
<td>Children</td>
<td>6–11</td>
<td>5–11</td>
</tr>
<tr>
<td>Teen</td>
<td>12–19</td>
<td>12–19</td>
</tr>
<tr>
<td>Adult</td>
<td>20+</td>
<td>20–70</td>
</tr>
</tbody>
</table>

2.5.6 Other Factors Not Considered in the Dietary Exposure Estimates

The effect of preparing, cooking, and/or baking (i.e., cooking and baking factors), and the percent of food items expected to have phthalates (i.e., akin to percent of crop treated in pesticide parlance) were not considered in this dietary exposure assessment because the data were either not available or the food item was already analyzed “as prepared or eaten.” Application of these factors would be expected to decrease overall phthalate exposure (i.e., fewer food items with phthalates, fewer phthalates in prepared food). Their exclusion, therefore, biases current results toward being more conservative.

2.6 Sensitivity Analysis to Determine the Effect of Categories with <3 Food Items

Total exposures from food categories with at least one food item were compared to those with more than three food items. This sensitivity analysis was performed in order to determine how a low N affected overall total phthalate exposure from foods.
### 3 Results

#### 3.1 Total Phthalate Exposure from Food Items When Utilizing Two Food Items/Residue Data sets and Three Methods for Categorizing Food Items

Total exposure from phthalates in food was evaluated for each residue dataset (Bradley, 2011); (Page and Lacroix, 1995) food categorization scheme (Wormuth et al., 2006; EPA, 2007; Clark et al., 2011) and population (infant, toddler, children, teen, adult). Average and 95th percentile total exposure values were calculated assuming 100% phthalate absorption, fractional absorption (Wormuth et al.[2006] absorption factors), and the percent of total exposure when considering food categories with only N=3+ food items can be seen in Section 4.2.

#### 3.2 Relative Contribution of Each Phthalate to Total Dietary Exposure

Circle graphs illustrating the relative contribution of all phthalates to total average dietary exposure were generated next. These can be seen in Section 4.3.

The relative contribution of phthalates was not substantially different when comparing total average exposures calculated assuming 100% phthalate absorption (Section 4.3) and total average exposure calculated using absorption data from Wormuth et al. (2006); circle graphs not shown.

##### 3.2.1 UK Dataset

When considering the UK (Bradley, 2011) residue dataset, all three food categorization schemes resulted in average total exposures (µg/kg-d) with the same comparative relationship (DINP > DIDP > DEHP > DDP) for all populations (Section 4.3). Total average exposures from other phthalates via food were substantially less than these four phthalates.

DINP residues were present for most of the food categories, but the majority of “residues” were replacement values (one-half the LOD/LOQ). Replacement values for DINP moderated the overall total dietary exposure from DINP because these were substantially lower than actual residues. DIDP and DDP total exposures were calculated entirely from replacement values (one-half LOD/LOQ). Comparison to DINP residue values suggested that values for DIDP (at least) were reasonable. DEHP total exposure estimates were calculated using a substantial number of residue values (when compared to replacement values).

##### 3.2.2 P&L Dataset

When considering P&L residue data (Page and Lacroix, 1995), the nonphthalate DEHA contributed to the largest portion of the average total exposure when assessing all categorization schemes and populations. Four other relationships were possible and dependent on the population and way food residues were categorized. Relationship 1 (DEHP>BBP>DEP>DBP) was primarily observed when food residues were grouped in NCEA categories (for infants, toddlers, children, female teens, and male teens). Relationship 2 (BBP>DEHP>DBP>DEP) was observed only following grouping by Wormuth et al. (2006; infants). Relationship 3 (DEHP>BBP>DBP>DEP) was observed when grouping with NCEA categories (EPA, 2007; female adult and male adult), Clark et al. (2011; infants), and Wormuth et al. (2006; toddler, female teen, male teen, female adult, and male adult). Relationship 4 (DEHP>DBP>BBP>DEP)
was observed following grouping residues as was done in Clark et al. (2011; toddler, children, female teen, male teen, female adult, and male adult) and Wormuth et al. (2006; children).

In this analysis, BBP exposures were calculated from only a few actual food residue data points. It is expected that this probably did not affect the phthalate order because of the moderating influence of the additional replacement values for BBP. Other phthalates (and DEHA) calculations were performed with a substantial number of residues in addition to the replacement values.

3.3 Relative Contribution of Each Phthalate to Each Food Category

Bar charts illustrating the relative contribution of all phthalates to total average dietary exposure in specific food categories were generated. These can be seen in Section 4.4. Summaries of this information can be seen in Tables E3-2, E3-3, and E3-4 below.

Table E3-2 Comparison of the contributors to exposure: NCEA (2007) categorization scheme.

<table>
<thead>
<tr>
<th>Population</th>
<th>Residue Data Set</th>
<th>Categorization Scheme</th>
<th>Relative Commodity Contribution to Exposure</th>
<th>Relative Phthalate Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant</td>
<td>UK</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DMP</td>
</tr>
<tr>
<td>Infant</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;others</td>
<td>DEHP&gt;others</td>
</tr>
<tr>
<td>Toddler</td>
<td>UK</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DMP</td>
</tr>
<tr>
<td>Toddler</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DEHP&gt;others</td>
</tr>
<tr>
<td>Children</td>
<td>UK</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
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<tr>
<td>Children</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>BBP&gt;meat; DEHP&gt;all others</td>
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<td>Female teen</td>
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<tr>
<td>Female teen</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DEHP&gt;others</td>
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<tr>
<td>Male teen</td>
<td>UK</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
</tr>
<tr>
<td>Male teen</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>BBP&gt;meats; DEHP&gt;all others</td>
</tr>
<tr>
<td>Female adult</td>
<td>UK</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
</tr>
<tr>
<td>Female adult</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>BBP&gt;meats; DEHP&gt;all others</td>
</tr>
<tr>
<td>Male adult</td>
<td>UK</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
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<tr>
<td>Male adult</td>
<td>P&amp;L</td>
<td>NCEA</td>
<td>Dairy=fat&gt;grain&gt;meat&gt;others</td>
<td>BBP&gt;meat; DEHP&gt;all others</td>
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<td>Population</td>
<td>Residue Data Set</td>
<td>Categorization Scheme</td>
<td>Relative Commodity Contribution to Exposure</td>
<td>Relative Phthalate Relationship</td>
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<td>UK</td>
<td>Clark infant formulas</td>
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<td>P&amp;L</td>
<td>Clark infant formulas</td>
<td>DEHP&gt;others</td>
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<tr>
<td>Toddler</td>
<td>UK</td>
<td>Clark Milk&gt;other foods&gt;grains&gt;dairy&gt;cereal&gt;fats and oils&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
<td></td>
</tr>
<tr>
<td>Toddler</td>
<td>P&amp;L</td>
<td>Clark Other foods&gt;dairy&gt;milk&gt;cereal&gt;vegetables&gt;meat&gt;others</td>
<td>BBP&gt;meat; DBP&gt;other foods; DEHP&gt;all others</td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>UK</td>
<td>Clark Milk&gt;other foods&gt;grains&gt;dairy&gt;cereal&gt;fats and oils&gt;meat&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
<td></td>
</tr>
<tr>
<td>Children</td>
<td>P&amp;L</td>
<td>Clark Other foods&gt;dairy&gt;vegetables&gt;milk&gt;meat&gt;fats and oils&gt;others</td>
<td>BBP&gt;cereal, meat; DBP&gt;other foods; DEHP&gt;all others</td>
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<tr>
<td>Female teen</td>
<td>UK</td>
<td>Clark Other foods&gt;milk&gt;grains&gt;fats and oils&gt;dairy&gt;meats&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
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<tr>
<td>Female teen</td>
<td>P&amp;L</td>
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<td>BBP&gt;meat; DBP&gt;other foods; DEHP&gt;all others</td>
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</tr>
<tr>
<td>Male teen</td>
<td>UK</td>
<td>Clark Other foods&gt;milk&gt;grains&gt;fats and oils&gt;meat&gt;meats&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
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<tr>
<td>Male teen</td>
<td>P&amp;L</td>
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<td>BBP&gt;meat; DBP&gt;other foods; DEHP&gt;all others</td>
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</tr>
<tr>
<td>Female adult</td>
<td>UK</td>
<td>Clark Other foods&gt;grains&gt;milk&gt;meat&gt;fats and oils&gt;meat&gt;meats&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
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</tr>
<tr>
<td>Female adult</td>
<td>P&amp;L</td>
<td>Clark Other foods&gt;dairy&gt;batteries&gt;meats&gt;vegetables&gt;other</td>
<td>BBP&gt;meat; DBP&gt;other foods; DEHP&gt;all others</td>
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</tr>
<tr>
<td>Male adult</td>
<td>UK</td>
<td>Clark Other foods&gt;grains&gt;milk&gt;meat&gt;fats and oils&gt;meat&gt;meats&gt;others</td>
<td>DINP&gt;DIDP&gt;DEHP&gt;DDP</td>
<td></td>
</tr>
<tr>
<td>Male adult</td>
<td>P&amp;L</td>
<td>Clark Other foods&gt;dairy&gt;batteries&gt;meats&gt;vegetables&gt;fats and oils&gt;meats&gt;meats&gt;others</td>
<td>BBP&gt;meat; DBP&gt;other foods; DEHP&gt;all others</td>
<td></td>
</tr>
</tbody>
</table>

Table E3-3  Comparison of the contributors to exposure: Clark et al. (2011) categorization scheme.
3.4 Effect of Removing Food Categories with N<3 Food Items on Total Exposure Estimates

Total exposure estimates from food were initially calculated using all residue data (and one-half LOD for nondetects) for either the UK (Bradley, 2011) or the Page and LaCroix (1995) datasets. This calculation included food categories that had only one food item (or composite sample).

Additional calculations for total food exposure were performed using only food categories that had N=3+ food items in order to determine how the number of items per category affected the total exposure.

Removing food categories with N<3 food items did not substantially affect the total exposures for any population (infants, toddlers, children, teens, or adults) when calculated using NCEA (EPA, 2007) or Clark et al. (2011) categorization schemes and the UK (Bradley, 2011) or Page and LaCroix (1995) food items/residue datasets.

Removing food categories with N<3 food items marginally reduced the total average exposure (but not the 95th percentile) when considering the Wormuth et al. (2006) food categorization scheme and the UK (Bradley, 2011) food item/residue dataset. Reductions of >10% of total exposure were seen for DPP (infants, toddlers, children, teens, female adults), DCHP (toddlers, female teens), DEHP (toddlers), DNOP (toddlers, female teens), DINP (toddlers, children), DIDP (toddlers, children), and DDP (toddlers, female teens).

Substantial decreases in total average and 95th percentile exposure were seen following removal of food categories with N<3 food items when considering Wormuth et al. (2006) food categorization scheme and the Page and LaCroix (1995) food residue dataset. Specifically, DEP, BBP, and DBP total average and 95th percentile exposures were reduced to 27–77% of the total exposure, and DEHP total average and 95th percentile exposures were reduced to 57–94% of the
total exposure for all populations when the food categories with N<3 food items were removed (calculations not shown).

4 Supplemental Data

4.1 Food Categorization Schemes Organized by Publication

Table E3-5 Food product groupings organized by study.

<table>
<thead>
<tr>
<th>General Food Category</th>
<th>NCEA (Total)</th>
<th>Clark et al., 2011</th>
<th>Wormuth et al., 2006</th>
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<td>Dairy</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Dairy</td>
<td></td>
<td>Milk</td>
<td>Milk, milk beverage</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dairy (excl. milk)</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Cream</td>
</tr>
<tr>
<td></td>
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<td>Ice cream</td>
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<td>Yogurt</td>
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<td></td>
<td></td>
<td></td>
<td>Cheese</td>
</tr>
<tr>
<td>Meat and egg</td>
<td></td>
<td>Meat</td>
<td>Meat, meat product</td>
</tr>
<tr>
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<td></td>
<td>Processed meat</td>
<td>Sausage</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Soup, sauce</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Poultry</td>
<td>Poultry</td>
</tr>
<tr>
<td></td>
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<td>Fish</td>
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<td></td>
<td>Egg</td>
<td>Egg</td>
</tr>
<tr>
<td>Grain, fruit, nut, and vegetable</td>
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<td>Grain</td>
<td>Pasta, rice</td>
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<td></td>
<td></td>
<td></td>
<td>Cereal</td>
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<td></td>
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<td>Breakfast cereal</td>
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<td></td>
<td></td>
<td>Bread</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Biscuit, crispy bread</td>
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<td></td>
<td></td>
<td></td>
<td>Cake bun, pudding</td>
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<td>Bakeries, snack</td>
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<td></td>
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<td>Vegetable</td>
<td>Vegetable</td>
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<tr>
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<td>Potato</td>
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<td>Soy</td>
<td>Soup, sauce</td>
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<td>Spread</td>
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<td>Other food</td>
<td>Confectionary</td>
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<td></td>
<td>Breast milk</td>
<td>Breast milk</td>
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<td>Commercial infant food</td>
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<td>Tea, coffee</td>
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<td>Soft drink</td>
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### 4.2 Total Exposure (µg/kg-d) Estimates for Various Populations (Wormuth Estimates Adjusted for the Fraction of the Population Consuming)

#### 4.2.1 Infants

**Table E3-6** Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

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<th>DEP</th>
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<th>DAP</th>
<th>DBP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
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<td>0.304</td>
<td>0.056</td>
<td>0.201</td>
<td>0.351</td>
<td>0.200</td>
<td>0.156</td>
<td>0.157</td>
<td>0.548</td>
<td>0.194</td>
<td>5.033</td>
<td>0.375</td>
<td>13.814</td>
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<tr>
<td>Wormuth</td>
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<td>0.543</td>
<td>0.285</td>
<td>1.283</td>
<td>0.807</td>
<td>0.728</td>
<td>0.474</td>
<td>0.452</td>
<td>0.875</td>
<td>0.594</td>
<td>4.670</td>
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<td>0.116</td>
<td>0.064</td>
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<td>0.182</td>
<td>0.074</td>
<td>0.124</td>
<td>0.212</td>
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<th>DiPP</th>
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<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
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<td>0.534</td>
<td>0.448</td>
<td>0.425</td>
<td>0.667</td>
<td>0.484</td>
<td>18.366</td>
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<td>Wormuth</td>
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<td>0.534</td>
<td>0.448</td>
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<td>35.819</td>
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**Table E3-7** Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.*, [2006] absorption factors).

<table>
<thead>
<tr>
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<th>DMP</th>
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<td>0.157</td>
<td>0.548</td>
<td>0.194</td>
<td>5.033</td>
<td>0.375</td>
<td>13.814</td>
</tr>
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<td>1.283</td>
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<td>0.190</td>
<td>6.730</td>
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<th>DEP</th>
<th>DiPP</th>
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<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
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<td>NCEA</td>
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<td>0.653</td>
<td>0.856</td>
<td>0.366</td>
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<td>1.061</td>
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### Table E3-8  Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

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### Table E3-9  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

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Table E3-10  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

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<td>22.695</td>
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<td>6.214</td>
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Table E3-11  Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

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</tbody>
</table>

4.2.2 Toddlers

Table E3-12  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

|          | DMP  | DEP  | DPDP | DAP  | DBP  | DBP  | DHP  | BBP  | DCHP | DEHP | DEP  | DION | DIOP | DDP  |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| NCEA     | Average 0.116 | 0.666 | 0.104 | 0.389 | 0.731 | 0.358 | 0.272 | 0.269 | 0.636 | 0.350 | 7.563 | 0.612 | 24.009 | 15.782 | 1.173 |
| Wormuth  | Average 0.085 | 0.164 | 0.086 | 0.369 | 0.286 | 0.199 | 0.173 | 0.131 | 0.285 | 0.231 | 1.758 | 0.354 | 10.611 | 8.371 | 0.735 |
| Clark    | Average 0.214 | 0.466 | 0.204 | 0.868 | 0.985 | 0.579 | 0.341 | 0.409 | 0.652 | 0.501 | 5.341 | 0.915 | 31.389 | 19.806 | 1.795 |
| NCEA     | 95th %ile 0.391 | 2.714 | 0.311 | 1.234 | 2.684 | 0.981 | 0.742 | 0.755 | 1.058 | 0.814 | 25.918 | 1.561 | 69.432 | 44.981 | 2.497 |
| Wormuth  | 95th %ile 0.274 | 0.396 | 0.204 | 0.934 | 0.739 | 0.456 | 0.409 | 0.281 | 0.733 | 0.395 | 4.273 | 0.754 | 21.592 | 19.433 | 1.248 |
| Clark    | 95th %ile 0.618 | 1.335 | 0.496 | 2.253 | 2.912 | 1.590 | 0.925 | 1.306 | 1.347 | 1.087 | 13.885 | 2.312 | 98.535 | 53.600 | 3.561 |
### Table E3-13  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

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### Table E3-14  Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

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</table>

### Table E3-15  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NCEA</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>7.779</td>
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<td>54.021</td>
<td>1881.092</td>
</tr>
<tr>
<td><strong>Wormuth</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2.504</td>
<td>5.044</td>
<td>4.279</td>
<td>8.506</td>
<td>127.384</td>
</tr>
<tr>
<td><strong>Clark</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>2.104</td>
<td>5.276</td>
<td>10.044</td>
<td>21.789</td>
<td>516.823</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95th %ile</td>
<td>14.543</td>
<td>16.760</td>
<td>15.685</td>
<td>175.753</td>
<td>6621.423</td>
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<tr>
<td><strong>Wormuth</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>95th %ile</td>
<td>2.517</td>
<td>8.163</td>
<td>8.124</td>
<td>21.645</td>
<td>399.093</td>
</tr>
<tr>
<td><strong>Clark</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>95th %ile</td>
<td>4.218</td>
<td>15.511</td>
<td>43.499</td>
<td>70.827</td>
<td>1914.344</td>
</tr>
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</table>
Table E3-16  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
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<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>5.328</td>
<td>6.611</td>
<td>4.578</td>
<td>29.819</td>
</tr>
<tr>
<td>Wormuth Average</td>
<td>1.715</td>
<td>3.657</td>
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<td>4.695</td>
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<tr>
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<td>Average</td>
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<td>3.825</td>
<td>6.880</td>
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</tr>
<tr>
<td></td>
<td>NCEA</td>
<td>9.692</td>
<td>12.151</td>
<td>10.744</td>
<td>97.015</td>
</tr>
<tr>
<td>Wormuth 95th %ile</td>
<td>1.724</td>
<td>5.918</td>
<td>5.565</td>
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<td>220.299</td>
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<tr>
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<td>2.889</td>
<td>11.245</td>
<td>29.797</td>
<td>39.097</td>
<td>1056.718</td>
</tr>
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</table>

Table E3-17  Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

<table>
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<tr>
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<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
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<td>99.4</td>
<td>99.2</td>
<td>99.9</td>
</tr>
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<td>Wormuth Average</td>
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<td>46.2</td>
<td>33.4</td>
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<td>93.4</td>
</tr>
<tr>
<td>Clark</td>
<td>Average</td>
<td>94.8</td>
<td>97.9</td>
<td>98.9</td>
<td>98.0</td>
</tr>
<tr>
<td></td>
<td>NCEA</td>
<td>99.6</td>
<td>99.7</td>
<td>99.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Wormuth 95th %ile</td>
<td>26.7</td>
<td>66.1</td>
<td>45.5</td>
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<td>96.1</td>
</tr>
<tr>
<td>Clark  95th %ile</td>
<td>97.4</td>
<td>99.3</td>
<td>99.7</td>
<td>99.4</td>
<td>98.3</td>
</tr>
</tbody>
</table>

4.2.3 Children

Table E3-18  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

<table>
<thead>
<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DiPP</th>
<th>DAP</th>
<th>DIBP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DiDP</th>
<th>DDMP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>0.088</td>
<td>0.344</td>
<td>0.051</td>
<td>0.229</td>
<td>0.406</td>
<td>0.209</td>
<td>0.160</td>
<td>0.157</td>
<td>0.391</td>
<td>0.199</td>
<td>4.224</td>
<td>0.353</td>
<td>13.697</td>
<td>9.039</td>
</tr>
<tr>
<td>Wormuth Average</td>
<td>0.045</td>
<td>0.086</td>
<td>0.042</td>
<td>0.177</td>
<td>0.154</td>
<td>0.079</td>
<td>0.065</td>
<td>0.151</td>
<td>0.096</td>
<td>0.940</td>
<td>0.174</td>
<td>5.588</td>
<td>4.122</td>
<td>0.354</td>
<td></td>
</tr>
<tr>
<td>Clark</td>
<td>Average</td>
<td>0.120</td>
<td>0.265</td>
<td>0.115</td>
<td>0.475</td>
<td>0.585</td>
<td>0.331</td>
<td>0.215</td>
<td>0.237</td>
<td>0.418</td>
<td>0.288</td>
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<td>0.569</td>
<td>17.376</td>
<td>12.350</td>
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<tr>
<td></td>
<td>NCEA</td>
<td>0.242</td>
<td>1.386</td>
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<td>1.477</td>
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<td>0.447</td>
<td>0.635</td>
<td>0.473</td>
<td>14.644</td>
<td>0.918</td>
<td>40.358</td>
<td>25.856</td>
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<tr>
<td>Wormuth 95th %ile</td>
<td>0.138</td>
<td>0.222</td>
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<td>0.443</td>
<td>0.414</td>
<td>0.245</td>
<td>0.209</td>
<td>0.154</td>
<td>0.432</td>
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<td>2.524</td>
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<td>11.900</td>
<td>10.199</td>
<td></td>
</tr>
<tr>
<td>Clark  95th %ile</td>
<td>0.358</td>
<td>0.777</td>
<td>0.279</td>
<td>1.209</td>
<td>1.811</td>
<td>0.892</td>
<td>0.561</td>
<td>0.720</td>
<td>0.797</td>
<td>0.616</td>
<td>8.736</td>
<td>1.289</td>
<td>51.247</td>
<td>35.163</td>
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</tr>
</tbody>
</table>

Appendix E3 – 16
Table E3-19  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DiPP</th>
<th>DAP</th>
<th>DiBP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>0.047</td>
<td>0.236</td>
<td>0.061</td>
<td>0.229</td>
<td>0.278</td>
<td>0.143</td>
<td>0.160</td>
<td>0.157</td>
<td>0.283</td>
<td>0.199</td>
<td>2.332</td>
<td>0.353</td>
<td>11.300</td>
<td>7.457</td>
<td>0.649</td>
</tr>
<tr>
<td>Wormuth</td>
<td>0.081</td>
<td>0.059</td>
<td>0.042</td>
<td>0.177</td>
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<td>0.069</td>
<td>0.079</td>
<td>0.065</td>
<td>0.109</td>
<td>0.096</td>
<td>0.519</td>
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<td>Clark</td>
<td>0.082</td>
<td>0.182</td>
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<td>0.475</td>
<td>0.401</td>
<td>0.227</td>
<td>0.215</td>
<td>0.237</td>
<td>0.303</td>
<td>0.288</td>
<td>1.766</td>
<td>0.509</td>
<td>14.335</td>
<td>10.188</td>
<td>0.969</td>
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</tbody>
</table>

Table E3-20  Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

<table>
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<th>DEP</th>
<th>DiPP</th>
<th>DAP</th>
<th>DiBP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Wormuth</td>
<td>95.3</td>
<td>98.1</td>
<td>96.8</td>
<td>97.1</td>
<td>95.7</td>
<td>96.4</td>
<td>83.6</td>
<td>93.2</td>
<td>95.5</td>
<td>90.5</td>
<td>91.8</td>
<td>91.3</td>
<td>89.6</td>
<td>88.9</td>
<td>92.3</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
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</table>

Table E3-21  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

<table>
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<tr>
<th></th>
<th>DEP</th>
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<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>4.052</td>
<td>5.371</td>
<td>3.642</td>
<td>28.485</td>
<td>967.766</td>
</tr>
<tr>
<td>Wormuth</td>
<td>0.726</td>
<td>2.309</td>
<td>3.498</td>
<td>5.640</td>
<td>83.413</td>
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</table>

<table>
<thead>
<tr>
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<th>95th %ile</th>
<th>95th %ile</th>
<th>95th %ile</th>
<th>95th %ile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wormuth</td>
<td>0.724</td>
<td>3.985</td>
<td>7.555</td>
<td>15.430</td>
<td>268.840</td>
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<tr>
<td>Clark</td>
<td>2.877</td>
<td>10.192</td>
<td>19.452</td>
<td>42.932</td>
<td>1001.810</td>
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</table>

Appendix E3 – 17
Table E3-22  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
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<tr>
<th></th>
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<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>2.775</td>
<td>3.894</td>
<td>2.495</td>
<td>15.724</td>
</tr>
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<td>Average</td>
<td>0.497</td>
<td>1.674</td>
<td>2.396</td>
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<tr>
<td>Clark</td>
<td>Average</td>
<td>0.988</td>
<td>2.593</td>
<td>3.272</td>
<td>7.332</td>
</tr>
<tr>
<td>NCEA</td>
<td>95th %ile</td>
<td>5.174</td>
<td>7.231</td>
<td>6.508</td>
<td>51.885</td>
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<td>95th %ile</td>
<td>0.496</td>
<td>2.889</td>
<td>5.175</td>
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</tr>
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<td>95th %ile</td>
<td>1.971</td>
<td>7.389</td>
<td>13.324</td>
<td>23.699</td>
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</table>

Table E3-23  Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

<table>
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<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>99.3</td>
<td>99.5</td>
<td>99.3</td>
<td>99.9</td>
</tr>
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<td>Wormuth</td>
<td>Average</td>
<td>44.7</td>
<td>54.9</td>
<td>33.3</td>
<td>72.9</td>
</tr>
<tr>
<td>Clark</td>
<td>Average</td>
<td>94.9</td>
<td>97.9</td>
<td>98.4</td>
<td>96.5</td>
</tr>
<tr>
<td>NCEA</td>
<td>95th %ile</td>
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<td>99.7</td>
<td>99.7</td>
<td>100.0</td>
</tr>
<tr>
<td>Wormuth</td>
<td>95th %ile</td>
<td>44.6</td>
<td>72.8</td>
<td>40.9</td>
<td>87.0</td>
</tr>
<tr>
<td>Clark</td>
<td>95th %ile</td>
<td>97.4</td>
<td>99.3</td>
<td>99.6</td>
<td>98.9</td>
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</tbody>
</table>

4.2.4  Female Teens

Table E3-24  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

|          | DMP    | DEP    | DiPP   | DAP    | DiBP   | DBP    | DPP    | DHP    | BBP    | DCHP   | DEHP   | DEHP   | DPP    | DHP    | BBP    | DCHP   | DEHP   | DEHP   |
|----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| NCEA     | Average| 0.038  | 0.158  | 0.033  | 0.123  | 0.203  | 0.113  | 0.089  | 0.086  | 0.228  | 0.105  | 2.172  | 0.190  | 7.197  | 4.783  | 0.331  |
| Wormuth  | Average| 0.030  | 0.109  | 0.028  | 0.105  | 0.152  | 0.091  | 0.065  | 0.064  | 0.121  | 0.081  | 1.083  | 0.139  | 5.768  | 3.815  | 0.248  |
| Clark    | Average| 0.058  | 0.128  | 0.055  | 0.223  | 0.285  | 0.163  | 0.106  | 0.120  | 0.215  | 0.141  | 1.640  | 0.250  | 8.675  | 6.061  | 0.458  |
| NCEA     | 95th %ile| 0.145  | 0.622  | 0.100  | 0.379  | 0.724  | 0.323  | 0.248  | 0.247  | 0.360  | 0.257  | 7.657  | 0.510  | 21.381  | 13.737  | 0.769  |
| Wormuth  | 95th %ile| 0.101  | 0.334  | 0.069  | 0.253  | 0.447  | 0.233  | 0.144  | 0.155  | 0.353  | 0.173  | 2.641  | 0.293  | 13.686  | 9.248  | 0.475  |
| Clark    | 95th %ile| 0.186  | 0.383  | 0.137  | 0.576  | 0.892  | 0.453  | 0.280  | 0.373  | 0.398  | 0.306  | 4.613  | 0.646  | 26.190  | 17.346  | 0.950  |
**Table E3-25** Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
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<th>DAP</th>
<th>DIBP</th>
<th>DBP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
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<td>0.108</td>
<td>0.033</td>
<td>0.123</td>
<td>0.139</td>
<td>0.077</td>
<td>0.089</td>
<td>0.086</td>
<td>0.165</td>
<td>0.105</td>
<td>1.199</td>
<td>0.190</td>
<td>5.937</td>
<td>3.946</td>
</tr>
<tr>
<td>Wormuth</td>
<td>0.021</td>
<td>0.075</td>
<td>0.028</td>
<td>0.105</td>
<td>0.104</td>
<td>0.063</td>
<td>0.065</td>
<td>0.064</td>
<td>0.088</td>
<td>0.081</td>
<td>0.986</td>
<td>0.139</td>
<td>4.758</td>
<td>3.147</td>
</tr>
<tr>
<td>Clark</td>
<td>0.040</td>
<td>0.088</td>
<td>0.055</td>
<td>0.223</td>
<td>0.195</td>
<td>0.112</td>
<td>0.106</td>
<td>0.120</td>
<td>0.156</td>
<td>0.141</td>
<td>0.905</td>
<td>0.250</td>
<td>7.157</td>
<td>5.000</td>
</tr>
</tbody>
</table>

|          | 95th %ile | 0.099 | 0.426 | 0.100 | 0.379 | 0.496 | 0.221 | 0.248 | 0.247 | 0.261 | 0.257 | 4.227 | 0.510 | 17.639 | 11.333 | 0.769 |
| Wormuth  | 95th %ile | 0.069 | 0.222 | 0.069 | 0.253 | 0.306 | 0.160 | 0.144 | 0.155 | 0.256 | 0.173 | 1.458 | 0.293 | 11.291 | 7.630 | 0.475 |
| Clark    | 95th %ile | 0.127 | 0.262 | 0.137 | 0.576 | 0.611 | 0.310 | 0.280 | 0.373 | 0.289 | 0.306 | 2.546 | 0.646 | 21.606 | 14.310 | 0.950 |

**Table E3-26** Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

<table>
<thead>
<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DIPP</th>
<th>DAP</th>
<th>DIBP</th>
<th>DBP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Wormuth</td>
<td>93.5</td>
<td>98.5</td>
<td>96.0</td>
<td>95.9</td>
<td>96.3</td>
<td>96.5</td>
<td>81.0</td>
<td>93.5</td>
<td>95.4</td>
<td>89.6</td>
<td>92.8</td>
<td>89.6</td>
<td>91.5</td>
<td>90.1</td>
</tr>
<tr>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

|          | 95th %ile | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Wormuth  | 97.3 | 99.5 | 98.3 | 98.3 | 98.2 | 98.4 | 91.6 | 96.8 | 98.4 | 93.2 | 97.1 | 94.8 | 95.7 | 95.6 |
| Clark    | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |

**Table E3-27** Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>1.902</td>
<td>3.002</td>
<td>1.812</td>
<td>13.685</td>
</tr>
<tr>
<td>Wormuth</td>
<td>Average</td>
<td>1.092</td>
<td>2.399</td>
<td>1.759</td>
<td>8.067</td>
</tr>
<tr>
<td>Clark</td>
<td>Average</td>
<td>0.806</td>
<td>2.090</td>
<td>2.521</td>
<td>6.858</td>
</tr>
</tbody>
</table>

|          | 95th %ile | 3.514 | 5.545 | 5.132 | 46.683 | 1476.424 |
| Wormuth  | 95th %ile | 1.062 | 3.974 | 3.563 | 20.166 | 481.277 |
| Clark    | 95th %ile | 1.621 | 5.902 | 10.285 | 22.274 | 526.376 |
### Table E3-28 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DEP (µg/kg-d)</th>
<th>BBP (µg/kg-d)</th>
<th>DBP (µg/kg-d)</th>
<th>DEHP (µg/kg-d)</th>
<th>DEHA (µg/kg-d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NCEA</strong></td>
<td>Average</td>
<td>1.303</td>
<td>2.177</td>
<td>1.242</td>
<td>7.554</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>2.407</td>
<td>4.020</td>
<td>3.515</td>
<td>25.769</td>
</tr>
<tr>
<td><strong>Wormuth</strong></td>
<td>Average</td>
<td>0.748</td>
<td>1.739</td>
<td>1.205</td>
<td>4.453</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>0.728</td>
<td>2.881</td>
<td>2.441</td>
<td>11.132</td>
</tr>
<tr>
<td><strong>Clark</strong></td>
<td>Average</td>
<td>0.552</td>
<td>1.516</td>
<td>1.727</td>
<td>3.786</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>1.110</td>
<td>4.279</td>
<td>7.045</td>
<td>12.295</td>
</tr>
</tbody>
</table>

### Table E3-29 Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

<table>
<thead>
<tr>
<th></th>
<th>DEP (µg/kg-d)</th>
<th>BBP (µg/kg-d)</th>
<th>DBP (µg/kg-d)</th>
<th>DEHP (µg/kg-d)</th>
<th>DEHA (µg/kg-d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NCEA</strong></td>
<td>Average</td>
<td>99.1</td>
<td>99.5</td>
<td>99.1</td>
<td>99.9</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>99.5</td>
<td>99.7</td>
<td>99.7</td>
<td>100.0</td>
</tr>
<tr>
<td><strong>Wormuth</strong></td>
<td>Average</td>
<td>49.5</td>
<td>54.3</td>
<td>54.8</td>
<td>54.8</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>48.1</td>
<td>65.4</td>
<td>58.7</td>
<td>75.4</td>
</tr>
<tr>
<td><strong>Clark</strong></td>
<td>Average</td>
<td>95.6</td>
<td>98.3</td>
<td>98.6</td>
<td>96.7</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>97.8</td>
<td>99.4</td>
<td>99.7</td>
<td>99.0</td>
</tr>
</tbody>
</table>

#### 4.2.5 Male Teens

### Table E3-30 Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

<table>
<thead>
<tr>
<th></th>
<th>DMP (µg/kg-d)</th>
<th>DEP (µg/kg-d)</th>
<th>DIPP (µg/kg-d)</th>
<th>DAP (µg/kg-d)</th>
<th>DBP (µg/kg-d)</th>
<th>DDP (µg/kg-d)</th>
<th>DBP (µg/kg-d)</th>
<th>BBP (µg/kg-d)</th>
<th>DCHP (µg/kg-d)</th>
<th>DEHP (µg/kg-d)</th>
<th>DOP (µg/kg-d)</th>
<th>DINP (µg/kg-d)</th>
<th>DIDP (µg/kg-d)</th>
<th>DDP (µg/kg-d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NCEA</strong></td>
<td>Average</td>
<td>0.038</td>
<td>0.158</td>
<td>0.033</td>
<td>0.123</td>
<td>0.203</td>
<td>0.113</td>
<td>0.089</td>
<td>0.086</td>
<td>0.228</td>
<td>0.105</td>
<td>2.172</td>
<td>0.190</td>
<td>7.197</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>0.145</td>
<td>0.622</td>
<td>0.100</td>
<td>0.379</td>
<td>0.724</td>
<td>0.323</td>
<td>0.248</td>
<td>0.247</td>
<td>0.360</td>
<td>0.257</td>
<td>7.657</td>
<td>0.510</td>
<td>21.381</td>
</tr>
<tr>
<td><strong>Wormuth</strong></td>
<td>Average</td>
<td>0.039</td>
<td>0.156</td>
<td>0.038</td>
<td>0.141</td>
<td>0.189</td>
<td>0.119</td>
<td>0.081</td>
<td>0.084</td>
<td>0.154</td>
<td>0.103</td>
<td>1.332</td>
<td>0.177</td>
<td>7.693</td>
</tr>
<tr>
<td></td>
<td>95th %ile</td>
<td>0.129</td>
<td>0.472</td>
<td>0.092</td>
<td>0.347</td>
<td>0.567</td>
<td>0.309</td>
<td>0.186</td>
<td>0.211</td>
<td>0.444</td>
<td>0.223</td>
<td>3.335</td>
<td>0.385</td>
<td>18.987</td>
</tr>
<tr>
<td><strong>Clark</strong></td>
<td>Average</td>
<td>0.058</td>
<td>0.128</td>
<td>0.055</td>
<td>0.223</td>
<td>0.285</td>
<td>0.163</td>
<td>0.106</td>
<td>0.120</td>
<td>0.215</td>
<td>0.141</td>
<td>1.640</td>
<td>0.250</td>
<td>8.675</td>
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<tr>
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<td>95th %ile</td>
<td>0.186</td>
<td>0.383</td>
<td>0.137</td>
<td>0.576</td>
<td>0.892</td>
<td>0.453</td>
<td>0.280</td>
<td>0.373</td>
<td>0.398</td>
<td>0.306</td>
<td>4.613</td>
<td>0.646</td>
<td>26.190</td>
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</tbody>
</table>
Table E3-31  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DiPP</th>
<th>DAP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>0.026</td>
<td>0.108</td>
<td>0.033</td>
<td>0.123</td>
<td>0.139</td>
<td>0.077</td>
<td>0.089</td>
<td>0.086</td>
<td>0.165</td>
<td>0.105</td>
<td>1.199</td>
<td>0.190</td>
<td>5.937</td>
<td>3.946</td>
</tr>
<tr>
<td>Wormuth</td>
<td>0.026</td>
<td>0.107</td>
<td>0.038</td>
<td>0.141</td>
<td>0.130</td>
<td>0.082</td>
<td>0.081</td>
<td>0.084</td>
<td>0.111</td>
<td>0.103</td>
<td>0.735</td>
<td>0.177</td>
<td>6.347</td>
<td>4.145</td>
</tr>
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<td>Clark</td>
<td>0.040</td>
<td>0.088</td>
<td>0.055</td>
<td>0.223</td>
<td>0.195</td>
<td>0.112</td>
<td>0.106</td>
<td>0.120</td>
<td>0.156</td>
<td>0.141</td>
<td>0.905</td>
<td>0.250</td>
<td>7.157</td>
<td>5.000</td>
</tr>
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<p>| | | | | | | | | | | | | | | | |</p>
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<tr>
<td>NCEA 95th %ile</td>
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<td>0.436</td>
<td>0.100</td>
<td>0.379</td>
<td>0.496</td>
<td>0.221</td>
<td>0.248</td>
<td>0.247</td>
<td>0.261</td>
<td>0.257</td>
<td>4.227</td>
<td>0.510</td>
<td>17.639</td>
<td>11.333</td>
<td>0.769</td>
</tr>
<tr>
<td>Wormuth 95th %ile</td>
<td>0.088</td>
<td>0.323</td>
<td>0.092</td>
<td>0.347</td>
<td>0.388</td>
<td>0.212</td>
<td>0.186</td>
<td>0.211</td>
<td>0.322</td>
<td>0.223</td>
<td>1.841</td>
<td>0.385</td>
<td>15.665</td>
<td>10.458</td>
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<tr>
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<td>0.127</td>
<td>0.262</td>
<td>0.137</td>
<td>0.576</td>
<td>0.611</td>
<td>0.310</td>
<td>0.280</td>
<td>0.373</td>
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<td>0.306</td>
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<td>0.646</td>
<td>21.606</td>
<td>14.310</td>
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</table>

Table E3-32 Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

<table>
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<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DiPP</th>
<th>DAP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
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<td>NCEA</td>
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<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>Wormuth</td>
<td>96.0</td>
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<td>97.6</td>
<td>97.8</td>
<td>87.9</td>
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<td>97.1</td>
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<td>94.6</td>
<td>93.6</td>
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<td>100.0</td>
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<table>
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<tr>
<td>Clark 95th %ile</td>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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<td></td>
</tr>
</tbody>
</table>

Table E3-33 Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>1.902</td>
<td>3.002</td>
<td>1.812</td>
<td>13.685</td>
<td>440.915</td>
</tr>
<tr>
<td>Wormuth</td>
<td>1.151</td>
<td>3.078</td>
<td>2.484</td>
<td>10.750</td>
<td>211.258</td>
</tr>
<tr>
<td>Clark</td>
<td>0.806</td>
<td>2.090</td>
<td>2.521</td>
<td>6.858</td>
<td>163.198</td>
</tr>
</tbody>
</table>

<p>| | | | | | |</p>
<table>
<thead>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA 95th %ile</td>
<td>3.514</td>
<td>5.545</td>
<td>5.132</td>
<td>46.683</td>
<td>1476.424</td>
</tr>
<tr>
<td>Wormuth 95th %ile</td>
<td>1.109</td>
<td>5.824</td>
<td>5.104</td>
<td>26.006</td>
<td>658.394</td>
</tr>
<tr>
<td>Clark 95th %ile</td>
<td>1.621</td>
<td>5.902</td>
<td>10.285</td>
<td>22.274</td>
<td>526.376</td>
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</tbody>
</table>
Table E3-34  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>1.303</td>
<td>2.177</td>
<td>1.242</td>
<td>7.554</td>
<td>243.385</td>
</tr>
<tr>
<td>Wormuth</td>
<td>0.788</td>
<td>2.231</td>
<td>1.702</td>
<td>5.934</td>
<td>116.614</td>
</tr>
<tr>
<td>Clark</td>
<td>0.552</td>
<td>1.516</td>
<td>1.727</td>
<td>3.786</td>
<td>90.085</td>
</tr>
<tr>
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<td>2.407</td>
<td>4.020</td>
<td>3.515</td>
<td>25.769</td>
<td>814.986</td>
</tr>
<tr>
<td>Wormuth</td>
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<td>4.222</td>
<td>3.497</td>
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<td>363.434</td>
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<tr>
<td>Clark</td>
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<td>7.045</td>
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<td>290.560</td>
</tr>
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</table>

Table E3-35  Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

<table>
<thead>
<tr>
<th></th>
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<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
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<td>99.1</td>
<td>99.5</td>
<td>99.1</td>
<td>99.9</td>
<td>99.2</td>
</tr>
<tr>
<td>Wormuth</td>
<td>62.9</td>
<td>61.8</td>
<td>58.9</td>
<td>57.2</td>
<td>89.7</td>
</tr>
<tr>
<td>Clark</td>
<td>95.6</td>
<td>98.3</td>
<td>98.6</td>
<td>96.7</td>
<td>97.5</td>
</tr>
<tr>
<td>NCEA</td>
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<td>99.7</td>
<td>99.7</td>
<td>100.0</td>
<td>99.5</td>
</tr>
<tr>
<td>Wormuth</td>
<td>61.6</td>
<td>72.6</td>
<td>62.9</td>
<td>76.3</td>
<td>93.7</td>
</tr>
<tr>
<td>Clark</td>
<td>97.8</td>
<td>99.4</td>
<td>99.7</td>
<td>99.0</td>
<td>98.5</td>
</tr>
</tbody>
</table>

4.2.6  Female Adults

Table E3-36  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

|          | DMP  | DEP  | DiPP | DAP  | DiBP | DBP  | DPP  | DHP  | BBP  | DCPP | DEHP | DEHP | DOP  | DNP  | DIP  | DDP  | DOP  |
|----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| NCEA     | 0.027| 0.031| 0.024| 0.086| 0.130| 0.078| 0.063| 0.060| 0.159| 0.071| 1.384| 0.129| 4.812| 3.198| 0.215| 99.9 |
| Wormuth  | 0.017| 0.042| 0.016| 0.066| 0.099| 0.051| 0.037| 0.032| 0.067| 0.041| 0.556| 0.066| 2.619| 2.102| 0.118| 66.1 |
| Clark    | 0.036| 0.087| 0.034| 0.131| 0.193| 0.108| 0.084| 0.142| 0.090| 1.142| 0.159| 5.998| 3.983| 0.273| 98.5 |
| NCEA     | 0.108| 0.037| 0.071| 0.261| 0.459| 0.227| 0.175| 0.175| 0.255| 0.176| 4.936| 0.356| 14.518| 9.259| 0.524| 96.0 |
| Wormuth  | 0.052| 0.114| 0.036| 0.151| 0.264| 0.117| 0.084| 0.078| 0.186| 0.086| 1.423| 0.144| 6.018| 5.860| 0.243| 100.0|
| Clark    | 0.122| 0.280| 0.086| 0.342| 0.616| 0.310| 0.178| 0.267| 0.261| 0.201| 3.242| 0.429| 18.706| 11.581| 0.611| 99.1 |
Table E3-37  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
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<th>DMP</th>
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<th>DiPP</th>
<th>DAP</th>
<th>DiBP</th>
<th>DBP</th>
<th>OPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
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</thead>
<tbody>
<tr>
<td>NCEA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>0.018</td>
<td>0.064</td>
<td>0.024</td>
<td>0.086</td>
<td>0.089</td>
<td>0.053</td>
<td>0.063</td>
<td>0.060</td>
<td>0.115</td>
<td>0.071</td>
<td>0.764</td>
<td>0.129</td>
<td>3.970</td>
<td>2.638</td>
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</tr>
<tr>
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<td>0.029</td>
<td>0.016</td>
<td>0.066</td>
<td>0.008</td>
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<td>0.037</td>
<td>0.032</td>
<td>0.049</td>
<td>0.041</td>
<td>0.307</td>
<td>0.066</td>
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<td>0.060</td>
<td>0.034</td>
<td>0.131</td>
<td>0.132</td>
<td>0.074</td>
<td>0.068</td>
<td>0.084</td>
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<td>0.090</td>
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<tr>
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<td>0.071</td>
<td>0.261</td>
<td>0.314</td>
<td>0.156</td>
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<td>0.175</td>
<td>0.185</td>
<td>0.176</td>
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<td>0.066</td>
<td>0.151</td>
<td>0.174</td>
<td>0.080</td>
<td>0.084</td>
<td>0.078</td>
<td>0.135</td>
<td>0.086</td>
<td>0.786</td>
<td>0.144</td>
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<td>4.835</td>
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Table E3-38  Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

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<tr>
<th></th>
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<th>DiPP</th>
<th>DAP</th>
<th>DiBP</th>
<th>DBP</th>
<th>OPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
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<tbody>
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<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
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</table>

Table E3-39  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

<table>
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<tr>
<th></th>
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<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
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<tbody>
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<td>NCEA</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>1.139</td>
<td>2.091</td>
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<td>8.472</td>
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<td></td>
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<td></td>
</tr>
<tr>
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<tr>
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<td>18.926</td>
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</table>
Table E3-40  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
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<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
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<td>Average</td>
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<td>1.516</td>
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<td>Average</td>
<td>0.662</td>
<td>2.184</td>
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<td>1.339</td>
<td>1.382</td>
<td>3.216</td>
</tr>
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<td>1.409</td>
<td>2.786</td>
<td>2.445</td>
<td>16.602</td>
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</table>

Table E3-41  Percent of total exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

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<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
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<td>Average</td>
<td>98.6</td>
<td>99.2</td>
<td>98.7</td>
<td>99.8</td>
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<td>60.8</td>
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<td>98.2</td>
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</tr>
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<td>99.6</td>
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</tr>
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<td>99.3</td>
<td>99.6</td>
<td>99.2</td>
</tr>
</tbody>
</table>

4.2.7  Male Adults

Table E3-42  Total exposure (µg/kg-d) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are 100% absorbed.

<table>
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<tr>
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<th>DMP</th>
<th>DEP</th>
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<th>DAP</th>
<th>DiBP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCBP</th>
<th>DEHP</th>
<th>DEHP</th>
<th>DEHP</th>
<th>DEHP</th>
<th>DEHP</th>
<th>DEHP</th>
<th>DEHP</th>
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<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>0.027</td>
<td>0.093</td>
<td>0.024</td>
<td>0.086</td>
<td>0.130</td>
<td>0.078</td>
<td>0.063</td>
<td>0.060</td>
<td>0.159</td>
<td>0.071</td>
<td>1.384</td>
<td>0.129</td>
<td>4.812</td>
<td>3.198</td>
<td>0.215</td>
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</tr>
<tr>
<td>Wormuth</td>
<td>Average</td>
<td>0.035</td>
<td>0.087</td>
<td>0.033</td>
<td>0.119</td>
<td>0.140</td>
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<td>5.218</td>
<td>3.988</td>
<td>0.236</td>
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<td>0.036</td>
<td>0.087</td>
<td>0.034</td>
<td>0.131</td>
<td>0.193</td>
<td>0.108</td>
<td>0.068</td>
<td>0.084</td>
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<td>0.159</td>
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<td>0.261</td>
<td>0.459</td>
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<td>0.175</td>
<td>0.255</td>
<td>0.176</td>
<td>4.916</td>
<td>0.356</td>
<td>14.518</td>
<td>9.259</td>
<td>0.524</td>
<td></td>
</tr>
<tr>
<td>Wormuth</td>
<td>95th %ile</td>
<td>0.129</td>
<td>0.251</td>
<td>0.089</td>
<td>0.304</td>
<td>0.381</td>
<td>0.247</td>
<td>0.196</td>
<td>0.178</td>
<td>0.448</td>
<td>0.177</td>
<td>2.871</td>
<td>0.329</td>
<td>11.834</td>
<td>10.485</td>
<td>0.521</td>
<td></td>
</tr>
<tr>
<td>Clark</td>
<td>95th %ile</td>
<td>0.122</td>
<td>0.280</td>
<td>0.086</td>
<td>0.342</td>
<td>0.616</td>
<td>0.310</td>
<td>0.178</td>
<td>0.267</td>
<td>0.261</td>
<td>0.201</td>
<td>3.242</td>
<td>0.429</td>
<td>18.706</td>
<td>11.581</td>
<td>0.611</td>
<td></td>
</tr>
</tbody>
</table>
Table E3-43  Total exposure ($\mu g/kg-d$) calculated using UK (Bradley, 2011) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth et al. [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DPP</th>
<th>DAP</th>
<th>DIBP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>0.018</td>
<td>0.004</td>
<td>0.024</td>
<td>0.086</td>
<td>0.089</td>
<td>0.053</td>
<td>0.063</td>
<td>0.060</td>
<td>0.115</td>
<td>0.071</td>
<td>0.764</td>
<td>0.129</td>
<td>3.970</td>
<td>2.638</td>
<td>0.215</td>
</tr>
<tr>
<td>Wormuth</td>
<td>0.024</td>
<td>0.080</td>
<td>0.033</td>
<td>0.119</td>
<td>0.096</td>
<td>0.064</td>
<td>0.080</td>
<td>0.070</td>
<td>0.105</td>
<td>0.081</td>
<td>0.575</td>
<td>0.140</td>
<td>4.305</td>
<td>3.290</td>
<td>0.236</td>
</tr>
<tr>
<td>Clark</td>
<td>0.025</td>
<td>0.060</td>
<td>0.034</td>
<td>0.131</td>
<td>0.132</td>
<td>0.074</td>
<td>0.068</td>
<td>0.084</td>
<td>0.103</td>
<td>0.090</td>
<td>0.630</td>
<td>0.159</td>
<td>4.874</td>
<td>3.286</td>
<td>0.273</td>
</tr>
</tbody>
</table>

|            | NCEA | 95th %ile | 0.074 | 0.244 | 0.071 | 0.261 | 0.314 | 0.156 | 0.175 | 0.175 | 0.185 | 0.176 | 2.713 | 0.356 | 11.977 | 7.638 | 0.524 |
| Wormuth    | 0.088 | 0.172 | 0.089 | 0.304 | 0.261 | 0.169 | 0.196 | 0.324 | 0.177 | 1.585 | 0.329 | 9.763 | 8.651 | 0.521 |
| Clark      | 0.084 | 0.192 | 0.086 | 0.342 | 0.422 | 0.212 | 0.178 | 0.267 | 0.190 | 0.201 | 1.790 | 0.429 | 15.433 | 9.554 | 0.611 |

Table E3-44  Percent of total exposure calculated using UK (Bradley, 2011) food residue data edited to discard food item categories with fewer than three residues.

<table>
<thead>
<tr>
<th></th>
<th>DMP</th>
<th>DEP</th>
<th>DPP</th>
<th>DAP</th>
<th>DIBP</th>
<th>DBP</th>
<th>DPP</th>
<th>DHP</th>
<th>BBP</th>
<th>DCHP</th>
<th>DEHP</th>
<th>DOP</th>
<th>DINP</th>
<th>DIDP</th>
<th>DDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
</tr>
<tr>
<td>Wormuth</td>
<td>96.948</td>
<td>98.909</td>
<td>98.043</td>
<td>97.836</td>
<td>97.836</td>
<td>97.975</td>
<td>91.052</td>
<td>96.665</td>
<td>97.126</td>
<td>94.353</td>
<td>96.182</td>
<td>94.460</td>
<td>93.684</td>
<td>93.466</td>
<td>94.255</td>
</tr>
<tr>
<td>Clark</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
<td>100.000</td>
</tr>
</tbody>
</table>

|            | NCEA | 95th %ile | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 |
| Clark      | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 | 100.000 |

Table E3-45  Total exposure ($\mu g/kg-d$) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are 100% absorbed.

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td>Average</td>
<td>1.139</td>
<td>2.091</td>
<td>1.179</td>
<td>8.472</td>
</tr>
<tr>
<td>Wormuth</td>
<td>Average</td>
<td>0.917</td>
<td>3.180</td>
<td>2.290</td>
<td>5.635</td>
</tr>
<tr>
<td>Clark</td>
<td>Average</td>
<td>0.741</td>
<td>1.847</td>
<td>2.018</td>
<td>5.826</td>
</tr>
</tbody>
</table>

|            | NCEA | 95th %ile | 2.057 | 3.843 | 3.569 | 30.076 | 829.443 |
| Wormuth    | 95th %ile | 0.950 | 6.256 | 4.540 | 18.775 | 415.293 |
| Clark      | 95th %ile | 1.535 | 5.087 | 7.965 | 18.926 | 432.221 |
**Table E3-46**  Total exposure (µg/kg-d) calculated using Page and LaCroix (1995) food residue data and the assumption that phthalates are fractionally absorbed (using Wormuth *et al.* [2006] absorption factors).

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td><strong>Average</strong></td>
<td>0.781</td>
<td>1.516</td>
<td>0.807</td>
<td>4.677</td>
</tr>
<tr>
<td>Wormuth</td>
<td><strong>Average</strong></td>
<td>0.628</td>
<td>2.305</td>
<td>1.569</td>
<td>3.111</td>
</tr>
<tr>
<td>Clark</td>
<td><strong>Average</strong></td>
<td>0.508</td>
<td>1.339</td>
<td>1.382</td>
<td>3.216</td>
</tr>
<tr>
<td>NCEA</td>
<td><strong>95th %ile</strong></td>
<td>1.409</td>
<td>2.786</td>
<td>2.445</td>
<td>16.602</td>
</tr>
<tr>
<td>Wormuth</td>
<td><strong>95th %ile</strong></td>
<td>0.651</td>
<td>4.536</td>
<td>3.110</td>
<td>10.364</td>
</tr>
<tr>
<td>Clark</td>
<td><strong>95th %ile</strong></td>
<td>1.051</td>
<td>3.688</td>
<td>5.456</td>
<td>10.447</td>
</tr>
</tbody>
</table>

**Table E3-47**  Percent of Total Exposure calculated using Page and LaCroix (1995) food residue data edited to discard food item categories with fewer than three residues.

<table>
<thead>
<tr>
<th></th>
<th>DEP</th>
<th>BBP</th>
<th>DBP</th>
<th>DEHP</th>
<th>DEHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCEA</td>
<td><strong>Average</strong></td>
<td>98.6</td>
<td>99.2</td>
<td>98.7</td>
<td>99.8</td>
</tr>
<tr>
<td>Wormuth</td>
<td><strong>Average</strong></td>
<td>48.5</td>
<td>61.8</td>
<td>46.0</td>
<td>73.9</td>
</tr>
<tr>
<td>Clark</td>
<td><strong>Average</strong></td>
<td>95.4</td>
<td>98.2</td>
<td>98.3</td>
<td>97.3</td>
</tr>
<tr>
<td>NCEA</td>
<td><strong>95th %ile</strong></td>
<td>99.2</td>
<td>99.6</td>
<td>99.6</td>
<td>99.9</td>
</tr>
<tr>
<td>Wormuth</td>
<td><strong>95th %ile</strong></td>
<td>43.1</td>
<td>76.8</td>
<td>54.3</td>
<td>88.2</td>
</tr>
<tr>
<td>Clark</td>
<td><strong>95th %ile</strong></td>
<td>97.8</td>
<td>99.3</td>
<td>99.6</td>
<td>99.2</td>
</tr>
</tbody>
</table>
4.3 Population-based Dietary Exposures and the Relative Contribution of Various Phthalates

4.3.1 Infants Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

**Figure E3-1** Infants total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
Figure E3-2 Infants total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
Figure E3-3  Infants total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.
Figure E3-4  Infants total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.
Figure E3-5  Infants total phthalate exposure from food (\(\mu g/\text{kg-d}\)); P&L data; Clark grouping.
Figure E3-6  Infants total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.
4.3.2 Toddlers Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

**Figure E3-7** Toddler total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
Figure E3-8  Toddlers phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
**Figure E3-9** Toddlers total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.
Figure E3-10  Toddlers total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.
Figure E3-11  Toddlers total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.
Figure E3-12  Toddlers total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.
4.3.3  Children Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-13  Children total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
Figure E3-14  Children total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
Figure E3-15  Children total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.
Figure E3-16  Children total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

Children Total Phthalate Exposure from Food (µg/kg-day);
P&L data; NCEA grouping

DEP
BBP
DBP
DEHP
DEHA
Figure E3-17  Children total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.
Figure E3-18 Children total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.
4.3.4 Female Teens Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-19 Female teens total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
Figure E3-20 Female teens total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
Figure E3-21  Female teens total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.
Figure E3-22  Female teens total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.
Figure E3-23  Female teens total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.
Figure E3-24  Female teens total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.
4.3.5 Male Teens Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

Figure E3-25 Male teens total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
Figure E3-26  Male teens total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
Figure E3-27  Male teens total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.
Figure E3-28 Male teens total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

Male Teen Total Phthalate Exposure from Food (ug/kg-day); P&L data; NCEA grouping
Figure E3-29 Male teens total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.
**Figure E3-30** Male teens total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.

![Male Teen Total Phthalate Exposure from Food (µg/kg-day); P&L data; Wormuth grouping](image)
4.3.6 Female Adults Total Phthalate Exposure from Food, Phthalate Relative Contribution (Assuming 100% Phthalate Absorption)

Figure E3-31 Female adults total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
**Figure E3-32** Female adults total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
Figure E3-33 Female adults total phthalate exposure from food (µg/kg-d); UK data; Wormuth grouping.
Figure E3-34  Female adults total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.

Female Adult Total Phthalate Exposure from Food (µg/kg-day); P&L data; NCEA grouping

- DEP
- BBP
- DBP
- DEHP
- DEHA
Figure E3-35  Female adults total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.

Female Adult Total Phthalate Exposure from Food (ug/kg-day); P&L data; Clark grouping
**Figure E3-36** Female adults total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.
4.3.7 Male Adults Total Phthalate Exposure from Food, Phthalate Relative Contribution (assuming 100% phthalate absorption)

**Figure E3-37** Male adults total phthalate exposure from food (µg/kg-d); UK data; NCEA grouping.
Figure E3-38  Male adults total phthalate exposure from food (µg/kg-d); UK data; Clark grouping.
Figure E3-39  Male adults total phthalate exposure from food (μg/kg-d); UK data; Wormuth grouping.
Figure E3-40  Male adults total phthalate exposure from food (µg/kg-d); P&L data; NCEA grouping.
Figure E3-41 Male adults total phthalate exposure from food (µg/kg-d); P&L data; Clark grouping.
Figure E3-42  Female adults total phthalate exposure from food (µg/kg-d); P&L data; Wormuth grouping.
4.4 Population-based Average Dietary Exposures and the Relative Contribution of Various Phthalates

4.4.1 Infants Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-43 Infants average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
Figure E3-44  Infants average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

<table>
<thead>
<tr>
<th>Food Group</th>
<th>DEHP</th>
<th>DIBP</th>
<th>BBP</th>
<th>DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total grain</td>
<td>0.5</td>
<td>0.2</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Total dairy</td>
<td>14.5</td>
<td>4.3</td>
<td>2.1</td>
<td>1.9</td>
</tr>
<tr>
<td>Total fish</td>
<td>0.1</td>
<td>0.05</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>Total meat</td>
<td>0.2</td>
<td>0.1</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Total fat</td>
<td>2.1</td>
<td>1.1</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>Total eggs</td>
<td>0.05</td>
<td>0.02</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Total vegetable</td>
<td>0.2</td>
<td>0.1</td>
<td>0.05</td>
<td>0.03</td>
</tr>
<tr>
<td>Total fruit</td>
<td>0.1</td>
<td>0.05</td>
<td>0.03</td>
<td>0.02</td>
</tr>
</tbody>
</table>
**Figure E3-45** Infants average dietary phthalate exposure (µg/kg-d); UK data, Clark food grouping.
Figure E3-46  Infants average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.
Figure E3-47 Infants average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
Figure E3-48  Infants average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
4.4.2  Toddlers Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-49  Toddlers average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
Figure E3-50  Toddlers average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.
Figure E3-51 Toddlers average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.
Figure E3-52 Toddlers average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.
Figure E3-53 Toddlers average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
Figure E3-54 Toddlers average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
4.4.3 Children Average Exposures and the Relative Contribution of Various Phthalates

Figure E3-55 Children average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
Figure E3-56  Children average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.
Figure E3-57  Children average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.
Figure E3-58  Children average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping
Figure E3-59  Children average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
Figure E3-60  Children average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
4.4.4 Female Teens Average Dietary Exposures and the Relative Contribution of Various Phthalates

**Figure E3-61** Female teens average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
Figure E3-62  Female teens average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.
Figure E3-63  Female teens average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.
Figure E3-64  Female teens average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.
Figure E3-65  Female teens average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
Figure E3-66  Female teens average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
4.4.5 Male Teens Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-67 Male teens average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
Figure E3-68  Male teens average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.
Figure E3-69  Male teens average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.
Figure E3-70  Male teens average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.
Figure E3-71  Male teens average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
Figure E3-72  Male teens average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
4.4.6 Female Adult Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-73 Female adults average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
**Figure E3-74** Female adults average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.
Figure E3-75  Female adults average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.
**Figure E3-76** Female adults average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.
**Figure E3-77** Female adults average dietary phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
**Figure E3-78** Female adults average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
4.4.7 Male Adults Average Dietary Exposures and the Relative Contribution of Various Phthalates

Figure E3-79 Male adult average dietary phthalate exposure (µg/kg-d); UK data; NCEA food grouping.
Figure E3-80  Male adults average dietary phthalate exposure (µg/kg-d); P&L data; NCEA food grouping.

Male Adult Average Dietary Phthalate exposure (ug/kg-day)
P&L data; NCEA food grouping
Figure E3-81  Male adults average dietary phthalate exposure (µg/kg-d); UK data; Clark food grouping.
**Figure E3-82** Male adults average dietary phthalate exposure (µg/kg-d); P&L data; Clark food grouping.
Figure E3-83  Male Adults Average Dietary Phthalate exposure (µg/kg-d); UK data; Wormuth food grouping.
Figure E3-84  Male adults average dietary phthalate exposure (µg/kg-d); P&L data; Wormuth food grouping.
5 References


