CSM
Chemical Sensitivities Manitoba

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Transmission by email:

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The Honourable Catherine McKenna
Minister of the Environment
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The Honourable Ginette Petitpas Taylor - Minister of Health
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Submission: Response to consultation document – Draft Screening Assessment of a Phthalate Substance Grouping - Canada Gazette, Part 1: Vol. 151, No. 40, October 7, 2017

Dear Minister Catherine McKenna and Minister Ginette Petitpas Taylor,

Please consider the following comments by Prevent Cancer Now (PCN) and Chemical Sensitivities Manitoba (CSM) in response to the Environment and Climate Change Canada and Health Canada consultation document: "Draft Screening Assessment of a Phthalate Substance Grouping".[1]

Summary of Recommendations

We recommend that determinations of metrics such as the Hazard Index be circumscribed with information regarding data strengths and limitations, including sensitivity. Poor quality information should not be substituted for evidence of lack of harm.

The ongoing and possibly increased use of some phthalates warrants a more precautionary approach and a public health perspective when considering their inclusion in consumer products and medical devices. Scientific evidence indicates that phthalates and metabolites affect the male fetus and eventual reproductive health of the adult male, as well as fetal and child development,

[1] Environment and Climate Change Canada and Health Canada. October 2017. Draft Assessment Screening Phthalate Substance Grouping.
http://www.ec.gc.ca/ese-ees/default.asp?lang=En&n=516A504A-1

homeostasis and metabolic disorders (associated with obesity, diabetes and cancers).

We recommend the removal of phthalates from products directed at vulnerable populations, such as medical supplies, infant supplies and toys, personal care and cleaning supplies and packaging, and eventually phase out phthalates, broadly. The human health implications resulting from phthalate exposure during vulnerable periods in life suggest that the current approach proposed by the government is not sufficiently precautionary. There is no safe exposure to phthalates for vulnerable populations. While also recognizing that even the most dedicated efforts to avoid phthalates on one's own are not enough and is impossible without regulation/elimination, we recommend that the government focus on education of vulnerable populations so that they can reduce their exposure to phthalates prior to and during pregnancy, infancy, and childhood through reproductive years.

The financial costs of human health and environmental effects associated with exposure to substances should be assessed and reported transparently. Chronic diseases are increasing quickly in Canada with financial costs outpacing GDP, and many social costs. Reducing incidence and severity of these conditions, to which phthalates are doubtless contributing to some degree, may represent large savings for the public purse.

Substitution of any of the phthalates in the Draft Screening Assessment must be informed by present and potential future human exposure levels (including metabolites) and potential effects, as well as experimental reproductive, neurotoxicity, metabolic and other evidence. Such research should include low and environmentally relevant doses, and transparent reporting of results. Scientific evidence should indicate that a new substance or replacement plasticizer, as well as all of its degradation products, is safe for human health and the environment, even at low exposure levels. Better still, alternative materials (e.g. free of polyvinylchloride (PVC)), that are inert and do not require dissolution of softeners (plasticizers) and other potential toxicants (e.g. stabilizers) should be a focus of research and be used as preferred alternatives.

OVERVIEW

Phthalates, used as plasticizers and ingredients in many commercial and consumer products, are ubiquitous in the environment and the population. Humans are exposed to phthalates through inhalation, food and dermal pathways. Internationally, these chemicals have been detected in human blood, breast milk and the urine of pregnant women. Canadian Health Measures Survey results indicate widespread, ongoing

exposure in Canadians.[2] Phthalates are common in liquids and plastics, where the substances are not chemically bonded. Thus they leach into foods and water, into saliva when mouthed by children, into dust, and into skin.

Some of the phthalates considered in the Draft Screening Assessment (dSAR) are manufactured and/or imported in significant quantities – see Appendix 1. For seven phthalates (2012 data), the quantities are greater than 10 million kg/year (e.g. DEHP) and for 14 phthalates, between 10,000 – 1 million kg/year (e.g. B79P). These quantities of chemical feedstocks do not include those present in imported products.

Only two phthalates: B79P, included in the Phthalate Substance Grouping; and DEHP, one of the additional phthalates considered in the evaluation of cumulative risk, were identified as being toxic under the *Canadian Environmental Protection Act,* 1999 (CEPA). These phthalates were listed as a result of environmental concerns, as potentially having an immediate or long-term harmful effect on the environment or its biological diversity under section 64 (a) of (CEPA). Human health was not a trigger, despite the fact that the International Agency for Research on Cancer (IARC) considers DEHP to be a Group 2B carcinogen; a possible human carcinogen.[3] As well, the European Commission classified DEHP, DBP, DnHP, and DIOP to be Category 1B reproductive toxicants as defined in the EU regulation on classification, labelling and packaging of substances and mixtures, and this year, the recommendation was passed to restrict phthalates in articles, such as flooring, coated fabrics and paper, recreational gear and equipment, mattresses, footwear, office supplies and equipment, and other articles moulded or coated with plastic, that cause exposure through the skin or by inhalation.[4]

In Canada, there are restrictions for DEHP, DBP, BBP, DINP, DIDP, and DNOP use in toys and child care articles,[5] and DEHP in medical devices [6] and personal care products.[7] In the United States, the Consumer Product Safety Commission has proposed to ban five phthalates (DIBP, DnPP, DINP, DnHP, DCHP) in toys, but this is yet to be finalized.

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[2] Health Canada. "Second Report on Human Biomonitoring of Environmental Chemicals in Canada." Navigation page. April 5, 2013. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/environmental-contaminants/second-report-human-biomonitoring-environmental-chemicals-canada-health-canada-2013.html.

[3] IARC Monograph for DEHP. http://monographs.iarc.fr/ENG/Monographs/vol101/mono101-006.pdf

[4] SEAC adopts restriction proposals on four phthalates and TDFAs in sprays used by the public. 2017 https://echa.europa.eu/-/seac-adopts-two-restriction-proposals-on-four-phthalates-and-on-tdfas-in-sprays-used-by-the-general-public

[5] Phthalate Regulations. Canada Consumer Product Safety Act. 2016. http://laws-lois.justice.gc.ca/eng/regulations/SOR-2016-188/page-1.html

[6] Ibid

[7] Ibid

Many phthalates included in the dSAR are considered to be endocrine disrupting chemicals (EDCs). The nature of the dose response is extremely complex. For instance, the effects at very low doses are likely to be very different from the effects at higher doses; and effects are related to the timing of exposures (developmental stage – prenatal versus infant versus child, etc.) mean that the toxicological concept “the dose makes the poison” is inaccurate when considering exposure to EDCs, including phthalates.

The dSAR contains considerable biomonitoring data, animal data in relation to phthalate exposures, and the impacts of prenatal and postnatal animal exposures. For many of the medium-chain phthalates, there is scientific evidence to indicate that these chemicals negatively impact fundamental physiological processes, and may have life-long impacts. One of the many adverse impacts is on the human male reproductive system, yet DEHP and B79P are the only two phthalates that were proposed to be considered toxic under CEPA. Moreover, this classification is for environmental rather than human impacts.

The dSAR proposes that exposure levels for the general population be considered safe at the current usage levels. We question the validity of that conclusion for a group of EDCs, for which very low exposure levels can have detrimental health outcomes for humans, depending on the time of exposure. In this situation, **it would be more appropriate for Canada to propose aggressive actions to better protect vulnerable populations from these substances, with a view to phase out and initiate an eventual ban of these substances in consumer products**. Today’s multiple, daily, ubiquitous phthalate exposures require broad risk management strategies, that are more aligned with the approaches being taken by Sweden and other progressive European countries, noted in the proposed Risk Management. With this in mind, we do not address in detail the Risk Management proposals. We note, however, that limited analytical sensitivity may have resulted in misleading conclusions regarding human exposures to some phthalates measured with inadequate methods, in the Canadian Health Measures Survey. Use of imprecise, inadequate analytical methods may undermine the effectiveness of any risk management program.

In support of more comprehensive reductions and eliminations of phthalates, this submission will address **human** health effects and recommended responses that would require further consideration by the government:

A) Prenatal phthalate exposure resulting in anogenital distance (AGD);
B) Other possible health implications resulting from phthalate exposure;
C) Financial implications resulting from phthalate exposure; and
D) Safer substitution of phthalates.

DISCUSSION & RECOMMENDATIONS

The medium-chain phthalates in the Grouping, as well as five of the listed additional phthalates (BBP, DBP, DEHP, DnHP, and DIOP), grouped because of similar modes of action, were cited in the dSAR for adverse male developmental health outcomes. While these chemicals may exhibit some similar modes of action, there are substantial data gaps. Given the complexities of endocrine-related effects, it is possible that additional health outcomes may occur that are not common to all the medium-chain phthalates.

There are significant gaps in the biomonitoring data presented in the dSAR for the medium-chain phthalates DIHepP, B79P, B84P, DCHP, and DIOP; they were included in the cumulative risk assessment on the basis of being detected in the Canadian House Dust Study.[8] Given rapid developments and changes in plastics and their uses over the years, it is unclear how house dust data collected over a decade ago is currently relevant, and how it can be confidently applied to exposure assessments in 2017.

With emphasis on three of the vulnerable populations for cumulative risks – pregnant women and women of childbearing age, infants and children, the dSAR concluded that the cumulative hazard index (∑HI) for the phthalates was still in the "safe" zone (<1) but increases in exposure would be of concern particularly for infants and children. The highest contributors to the ∑HI were DEHP, DINP and DBP. Given that some individual values are approaching unity (0.82), uncertainties and combined exposures with other common toxicants could very conceivably push the ∑HI over unity.

It is also important that data be sufficiently sensitive. Of note, the average limit of detection for phthalates that were commonly detected in the Canadian Health Measures Survey (CHMS) is 0.2 µg/L, whereas the limit of detection for those uncommonly detected is 1.5 µg/L. In other words, less sensitive tests used in the CHMS may be the reason for not detecting some phthalates. This practice invalidates Hazard Index determinations, as lack of detections may be the result of insensitive testing. It is essential that all such information be couched in the limitations of the data.

[8] Canada, Health, and Health Canada. "The Canadian House Dust Study." Research: education and awareness. March 12, 2007. https://www.canada.ca/en/health-canada/services/environmental-workplace-health/environmental-contaminants/canadian-house-dust-study.html.

Table 1. Detections, and detection limits for phthalates in the Canadian Health Measures Survey Cycles 1 and 2

Phthalate	Limit of Detection – Cycle 1 (µg/L)	Limit of Detection – Cycle 2 (µg/L)
Near-universal detection		
MBzP	0.2	0.05
MnBP	0.2	0.2
MiBP	-	0.1
MEP	0.5	0.3
> 90% detected		
MCPP	0.2	0.06
MEHP	0.2	0.08
MEOHP	0.2	0.1
MEHHP	0.4	0.4
Average LoD for commonly detected phthalates	**0.2**	
Less commonly detected		
MCHP	0.2	0.09
MiNP	0.4	0.3
MMP	5	5
MOP	0.7	0.3
Average LoD for phthalates frequently not detected	**1.5 (driven by MMP LoD)**	

Recommendation

We recommend that determinations of metrics such as the Hazard Index be circumscribed with information regarding data strengths and limitations, including sensitivity. Poor quality information should not be substituted for evidence of lack of harm.

The human health impacts from phthalate exposure at low levels raise the question about impacts on vulnerable populations – is there any reliably "safe" level of exposure for substances that are EDCs? We describe here some of the increasing incidence of human health effects to which phthalates may be contributing, that are not chronicled in the dSAR.

In the discussion below, recent scientific research on the complex nature of phthalates and EDCs and their impacts on human health, with emphasis on vulnerable populations, is presented with recommendations. In light of this evidence, it is prudent to recommend limiting and where possible eliminating use of consumer products containing phthalates by pregnant women, the very young and other vulnerable subpopulations.

A) Prenatal phthalate exposure - anogenital distance (AGD)

A shorter anogenital distance (AGD), a male genital birth defect, is related to impaired reproductive function in adult males and is used in the assessment of reproductive toxicity in laboratory animals. This genital birth defect in males can be observed after prenatal exposure to some phthalates.

A 2015 study reviewed other human studies indicating associations between prenatal phthalate exposure and the shortening of the AGD, and reported on the associations between prenatal phthalate exposure during the first-trimester and AGD at 21 months of age.[9] The urine of the 196 Swedish infants was analyzed for 10 phthalate metabolites of DEP, DBP, DEHP, BBzP (benzylbutyl phthalate), DINP, along with creatinine. [10] All metabolites were present in urine samples above the limit of detection. The study found that the most highly significant associations were found between the shorter of two AGD measures (anoscrotal distance) and DINP metabolites, and strongest for metabolites oh-MMeOP [mono-(4-methyl-7-hydroxyloctyl) phthalate] and oxo-MMeOP [mono-(2-ethyl-5-oxohexyl) phthalate]. Another study, expected to be released by Bornehag, will also identify the significant relationship between prenatal phthalate exposure and decreased ADG.[11]

Of particular concern, DINP is replacing DEHP in soft PVC in some jurisdictions and the human biomonitoring data of DINP metabolites reflects this change. The dSAR also references animal data for DINP, concluding that it possibly has similar antiandrogenic properties to those of DEHP.

In short, environmentally relevant exposures can cause harm, and should be viewed as distinct from higher exposures. We question the proposed conclusion by the federal government that there is a safe exposure level for phthalates. As a result of their endocrine disrupting properties, there is no safe exposure level for vulnerable populations.

[9] Bornehag CG, Carlstedt F, Jönsson BA, Lindh CH, Jensen TK, Bodin A, Jonsson C, Janson S, Swan SH. 2015. Prenatal phthalate exposures and anogenital distance in Swedish boys. Environ Health Perspect. 2015 Jan; 123(1):101-7. https://www.ncbi.nlm.nih.gov/pubmed/25353625
[10] Ibid
[11] Bornehag CG. 2017. Webinar on phthalates hosted by the Canadian Network for Health and the Environment (CNHHE), Canada.

B) Other health effects associated with phthalate exposures

EDCs can have the potential to disrupt hormone-mediated processes that are critical during gestation, infancy and childhood, during the growth and development stages. These sub-populations are generally more sensitive to environmental stressors such as phthalates.

There is a mounting scientific evidence of other effects of phthalates on human health – prenatal and postnatal. While some of these studies require further investigation and refinement so that the conclusions are more definitive, there is still a body of sound evidence detailing the impacts on human health. The cases cited below are some new human studies that should be considered in the government's risk assessment.

- Placental changes

A 2017 study investigated the associations between phthalate exposure in each trimester and placental size and shape at birth of 2725 pregnant women. Phthalates investigated were MMP, MBP, and two oxidative metabolites of DEHP – MEOHP and MEHHP. The results suggest that prenatal exposure to some phthalates could affect placental size and shape, resulting in the placenta becoming thicker and more circular. This association appeared to be stronger for the subsample representing male offspring than the female subset.[12] Although two of the phthalates are not included in the dSAR, the results are still relevant as they add to the overall body of scientific evidence of harm from environmentally relevant exposures to phthalates.

- Thyroid effects

Several studies have consistently shown an association whereby phthalate exposure negatively impacts the thyroid hormones in pregnant women as well as the general population. It may not always be evident as to whether any effects could differ by gestational age and which phthalates are having the greatest impact. This body of research is summarized in a recent report of a study of 1379 pregnant women. Serum concentrations of MEP, MBP and MEHP were related to levels of thyroid hormones. The authors concluded that there is likely an association between serum phthalates and total thyroxine levels (TT4), with MBP and MEHP, having the most pronounced effects on TT4 concentrations throughout the early pregnancy, possibly beginning during the embryonic stage (gestational weeks 5 to 8).[13]

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[12] Zhu YD, Gao H, Huang K, Zhang YW, Cai XX, Yao HY, Mao LJ, Ge X, Zhou SS, Xu YY, Jin ZX, Sheng J, Yan SQ, Pan WJ, Hao JH, Zhu P, Tao FB. 2017. Prenatal phthalate exposure and placental size and shape at birth: A birth cohort study. Environ Res. 2017 Oct 10;160: 239-246.

[13] Gao H, Wu W, Xu Y, Jin Z, Bao H, Zhu P, Su P, Sheng J, Hao J, Tao F. 2017. Effects of Prenatal Phthalate Exposure on Thyroid Hormone Concentrations Beginning at The Embryonic Stage. Sci Rep. 2017 Oct 12;7(1):13106. https://www.ncbi.nlm.nih.gov/pubmed/29026179

More evidence of decreased thyroid hormones is evident from the 2007-2008 National Health and Nutrition Examination Survey (NHANES) from the United States, which included urinary levels of environmental phenols, parabens, and phthalate metabolites and their effects on serum thyroid hormones. Urinary benzophenone-3 (BP-3) and DEHP exposures were associated with lower thyroid hormones levels among the general population.[14] It is also important to note that other common environmental chemicals could contribute to similar effects. Thyroid hormone levels have many essential roles during early development.

- Allergic diseases

There has been a significant increase in the incidence rate of allergic and autoimmune diseases, including asthma. While there is conflicting data, some studies implicate prenatal and postnatal exposure to environmental factors, including phthalates (plasticizers), in the development of allergies.

A 2017 study investigated the effect of maternal phthalate exposure on asthma development in subsequent generations as well as underlying mechanisms, including epigenetic alterations. It was concluded that the maternal presence of the metabolite of BBP – MnBP – is associated with an increased risk of asthma in children.[15] Also, in mouse studies, maternal exposure to BBP enhanced airway inflammation over two generations, through epigenetic alterations.[16] These results include some mechanistic pathways but also point towards the possibility of the development of other immune-related diseases.

Research implicating epigenetic alterations will require additional investigation; nevertheless, the current scientific data indicates that more caution and government intervention are required with respect to the use of phthalate-containing consumer products by women of reproductive age and the young.

[14] Kim S, Kim S, Won S, Choi K. 2017. Considering common sources of exposure in association studies - Urinary benzophenone-3 and DEHP metabolites are associated with altered thyroid hormone balance in the NHANES 2007-2008. Environ Int. 2017 Oct; 107:25-32. https://www.ncbi.nlm.nih.gov/pubmed/28651165

[15] Susanne Jahreis, et al. 2017. Maternal phthalate exposure promotes allergic airway inflammation over 2 generations through epigenetic modifications. J Allergy Clin Immunol. 2017. http://www.jacionline.org/article/S0091-6749(17)30570-5/pdf

[16] Ibid

- Neurodevelopment

A 2017 study examined epidemiological studies and the relationship between early-life exposure to bisphenol A (BPA), phthalates, triclosan and perfluoroalkyl substances (PFAS) and childhood neurobehavioural disorders and obesity.[17] The epidemiological evidence suggests that prenatal exposure to several EDCs is associated with adverse neurobehaviour (BPA and phthalates) and excess adiposity or increased risk of obesity and/or overweight (PFAS).[14] While this is not new evidence, the study suggested several areas that require further research to improve estimates of the EDC exposures and effects on child health, that would eventually lead to public health interventions to reduce these exposures.

- Obesity and related conditions

As endocrine disruptors, phthalates are associated with numerous mechanisms that culminate in obesity.[18] These chemicals are considered "obesogens." Obesity is related to multiple diseases, such as diabetes which is increasing at several percent per year in Canadian children.[19] Eleven cancers are associated with adiposity.[20] The role of obesogens that also trigger pathways to cancer deserve concerted action by government.[21]

- Other endocrine-related outcomes

There is published data that link plasticizers DINP and DIDP to a rise in the risk of hypertension and diabetes in children and adolescents.[22] The same study also mentions an *in vitro* study at Canada's McGill University indicating that metabolites of phthalate-

[17] Braun JM. 2017. Early-life exposure to EDCs: role in childhood obesity and neurodevelopment. Nat Rev Endocrinol. 2017 Mar;13(3):161-173. https://www.ncbi.nlm.nih.gov/pubmed/27857130
[18] Kim, Shin Hye, and Mi Jung Park. "Phthalate Exposure and Childhood Obesity." Annals of Pediatric Endocrinology & Metabolism 19, no. 2 (June 2014): 69–75. https://doi.org/10.6065/apem.2014.19.2.69
[19] Halipchuk, Julie, Beverley Temple, Allison Dart, Donna Martin, and Elizabeth A. C. Sellers. "Prenatal, Obstetric and Perinatal Factors Associated with the Development of Childhood-Onset Type 2 Diabetes." *Canadian Journal of Diabetes*, June 2, 2017. https://doi.org/10.1016/j.jcjd.2017.04.003.
[20] World Cancer Research Fund International. 2017. Cancers linked to being overweight or obese. Retrieved: December 5, 2017. http://www.wcrf.org/int/cancer-facts-figures/link-between-lifestyle-cancer-risk/cancers-linked-being-overweight-or
[21] Goodson, William H., Leroy Lowe, David O. Carpenter, Michael Gilbertson, Abdul Manaf Ali, Adela Lopez de Cerain Salsamendi, Ahmed Lasfar, et al. "Assessing the Carcinogenic Potential of Low-Dose Exposures to Chemical Mixtures in the Environment: The Challenge Ahead." Carcinogenesis 36, no. Suppl 1 (June 2015): S254–96. https://doi.org/10.1093/carcin/bgv039.
[22] Additives for Polymers. New studies raise concerns over DINP, DIDP and DINCH plasticizers. 2015. ScienceDirect: Volume 2015, Issue 11. November 2015, Page 11. http://www.sciencedirect.com/science/article/pii/S0306374715301597

replacement plasticizer (DINCH) may have disruptive impacts on the mammalian endocrine system.[23]

In conclusion, EDCs can have the potential to disrupt hormone-mediated processes that are critical during gestation, infancy and childhood, during the growth and development stages. These sub-populations are generally more sensitive to environmental stressors such as phthalates.

Recommendations

The ongoing and possibly increased use of some phthalates warrants a more precautionary approach and a public health perspective when considering their inclusion in consumer products and medical devices. Scientific evidence indicates that phthalates and metabolites affect the male fetus and eventual reproductive health of the adult male, as well as fetal and child development, homeostasis and metabolic disorders (associated with obesity, diabetes and cancers).

We recommend the removal of phthalates from products directed at vulnerable populations, such as medical supplies, infant supplies and toys, personal care and cleaning supplies and packaging, and eventually phase out phthalates, broadly. The human health implications resulting from phthalate exposure during vulnerable periods in life suggest that the current approach proposed by the government is not sufficiently precautionary. There is no safe exposure to phthalates for vulnerable populations. While also recognizing that even the most dedicated efforts to avoid phthalates on one's own are not enough and is impossible without regulation/elimination, we recommend that the government focus on education of vulnerable populations so that they can reduce their exposure to phthalates prior to and during pregnancy, infancy, and childhood through reproductive years.

- <u>Financial impacts of phthalate exposure</u>

Considerable financial burdens are associated with many health effects resulting from phthalate exposures and EDCs in general.[24] Assessments do not include this type of information that is critical to give a more realistic picture of the impacts of chemical exposures. The financial burdens are experienced not only by those who have been affected by phthalate exposures but also the family and care-givers, the health system,

[23] Ibid

[24] Disease Burden and Costs Due to Endocrine Disrupting Chemicals. New York University (NYU), Department of Pediatrics. 2016. https://med.nyu.edu/pediatrics/research/environmentalpediatrics/policy-research/disease-burden-and-costs-due-endocrine-disrupting-chemicals

and others in the workplace. In other words, financial burdens affect not only industries when risk management instruments are employed, or not. In Canada, the growth in costs of chronic diseases (to which EDCs are contributing)[25] are outpacing Gross Domestic Product (GDP).[26]

Recommendation

The financial costs of human health and environmental effects associated with exposure to substances should be assessed and reported transparently. Chronic diseases are increasing quickly in Canada with financial costs outpacing GDP, and many social costs. Reducing incidence and severity of these conditions, to which phthalates are doubtless contributing to some degree, may represent large savings for the public purse.

- Safer substitution for phthalates

In some jurisdictions, there has been a decline in the use of DEHP; DINP is being used as a replacement phthalate and its usage is increasing globally. Scientific evidence indicates that DINP may also have anti-androgenic properties similar to those for DEHP, as animal data suggests that DINP can negatively impact the AGD in males. There is no data in the dSAR to indicate if the imported and/or manufactured amounts of DEHP are actually declining or about the possibility that DINP is being used as a replacement plasticizer in soft PVC toys.

Phthalates are also used in some consumer products as a medium for dissolution of perfumes and possibly other ingredients. Some of these products are applied directly to the skin, while in products such as fabric softeners, they impregnate the fabric. Phthalates are then absorbed through the skin and are shed from fabrics into dust. This area requires government focus as skin exposure to phthalates could be reduced with (if feasible) safer substitution or (preferably) the elimination of these applications. Consideration should be given to the elimination of potentially harmful substances and even types of products for which fundamentally safer strategies are feasible (e.g. phthalates to prolong fragrances in cleaning and fabric softening products do not contribute to the primary purpose, but do pose and potentiate risks).

[25] Public Health Agency of Canada. “How Healthy Are Canadians?” Education and awareness, March 8, 2017. https://www.canada.ca/en/public-health/services/publications/healthy-living/how-healthy-canadians.html.
[26] Canadian Institute for Health Information. 2017. How much does Canada spend on healthcare? https://www.cihi.ca/en/how-much-does-canada-spend-on-health-care-2017

The scope of alternatives consideration is important. Recent Canadian Blood Services investigation of alternatives for medical devices are limited to alternative phthalates (including the aforementioned DINCH),[27] whereas other investigations of the same topic include alternative plastics that do not require plasticizers.[28]

Polyvinyl chloride (PVC) is a brittle plastic that is only useful when additional chemicals are dissolved within the solid to soften it. Significant other negative aspects regarding PVC are that it is toxic to produce, requires heavy metals for stabilization, and produces dioxins when burned. In the environment, it is very persistent.[29,30] Rather than substitute phthalates in PVC, a safer substitute for PVC should be addressed by the government.

Of note, in 2002, a review was prepared for Health Canada on the plasticizer DEHP. The panel was led by Dr. Robin Walker (then president of the Canadian Paediatric Society and head of the neonatal intensive care unit at the Children's Hospital of Eastern Ontario).[31] The report indicated that DEHP levels leaching from medical devices were likely sufficient to affect development of the premature male infants and recommended that phthalate-free versions (currently available in the European Union, but not North America).

Recommendation

Substitution of any of the phthalates in the Draft Screening Assessment must be informed by present and potential future human exposure levels (including metabolites) and potential effects, as well as experimental reproductive, neurotoxicity, metabolic and other evidence. Such research should include low and environmentally relevant doses, and transparent reporting of results. Scientific evidence should indicate that a new substance or replacement

[27] Serrano, K., E. Levin, D. Chen, A. Hansen, T. R. Turner, J. Kurach, A. Reidel, W. F. Boecker, J. P. Acker, and D. V. Devine. "An Investigation of Red Blood Cell Concentrate Quality during Storage in Paediatric-Sized Polyvinylchloride Bags Plasticized with Alternatives to Di-2-Ethylhexyl Phthalate (DEHP)." *Vox Sanguinis* 110, no. 3 (April 1, 2016): 227–35. https://doi.org/10.1111/vox.12355.

[28] Van Vliet, EDS, EM Reitano, JS Chhabra, GP Bergen, and RM Whyatt. "A Review of Alternatives to Di (2-Ethylhexyl) Phthalate-Containing Medical Devices in the Neonatal Intensive Care Unit." *Journal of Perinatology* 31, no. 8 (August 2011): 551–60. https://doi.org/10.1038/jp.2010.208.

[29] Yang CZ, Yaniger SI, Jordan VC, Klein DJ, Bittner GD. Most Plastic Products Release Estrogenic Chemicals: A Potential Health Problem That Can Be Solved. Environ Health Perspect. 2011 Jul 1;119 (7):989–96.

[30] Lithner, Delilah, Åke Larsson, and Göran Dave. "Environmental and Health Hazard Ranking and Assessment of Plastic Polymers Based on Chemical Composition." *Science of The Total Environment* 409, no. 18 (August 15, 2011): 3309–24. https://doi.org/10.1016/j.scitotenv.2011.04.038.

[31] Walker R, Branch B, Flaman Z, et al. EAP on DEHP in medical devices panel report. Previously available at <http://www.hc-sc.gc.ca/dhp-mps/md-im/activit/sci-consult/dehp/sapdehp_rep_gcsdehp_rap_2002-01-11-eng.php> (Version current June 12, 2008).

plasticizer, as well as all of its degradation products, is safe for human health and the environment, even at low exposure levels. Better still, alternative materials (e.g. free of polyvinylchloride (PVC)), that are inert and do not require dissolution of softeners (plasticizers) and other potential toxicants (e.g. stabilizers) should be a focus of research and be used as preferred alternatives.

We thank you for the opportunity to comment on this important topic. We urge the Government of Canada to consider seriously, the incremental contributions of many chemicals to the mounting chronic diseases and non-smoking related cancers in Canada. We hope that you will recognize this opportunity to apply rigorous measures to ensure that least-toxic approaches are adopted, and to preclude substitution with data-poor and/or hazardous substitutes.

Respectfully submitted by:

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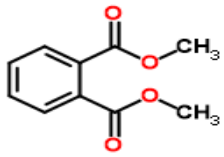
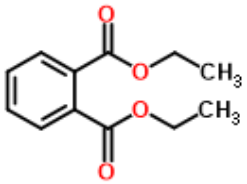
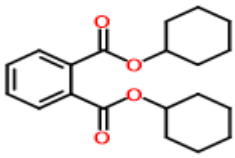
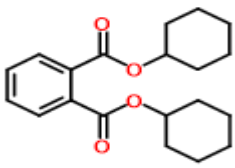
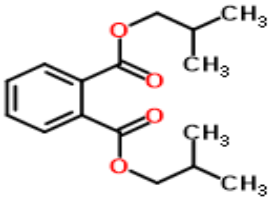
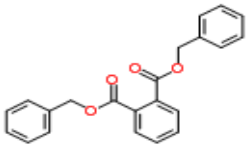
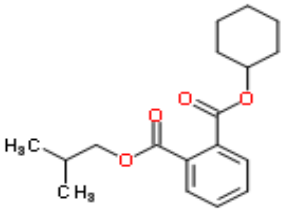
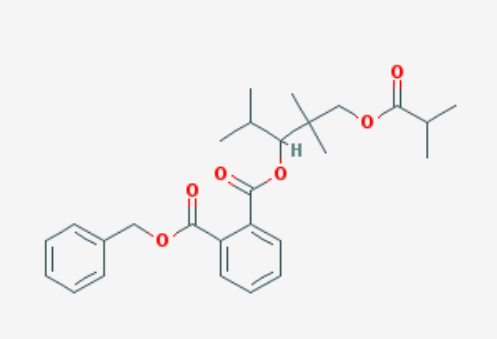
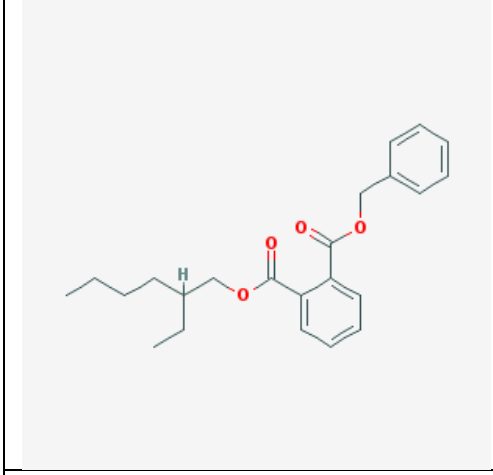
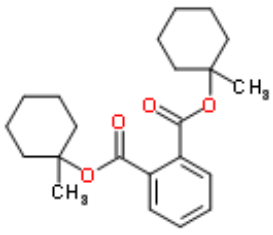
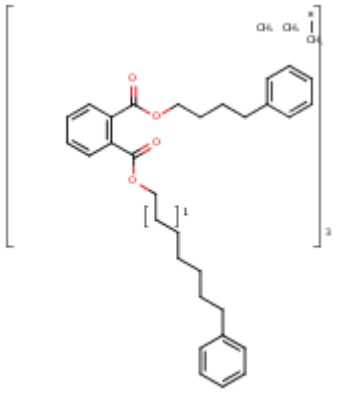
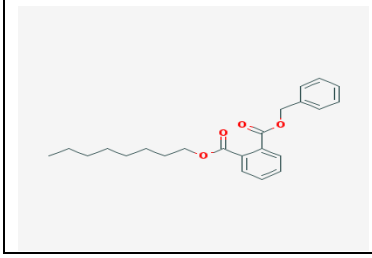
Appendix 1

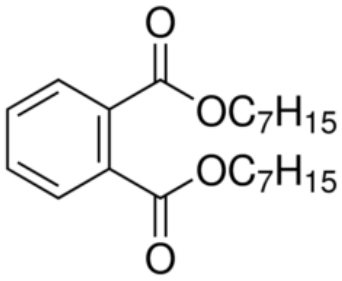
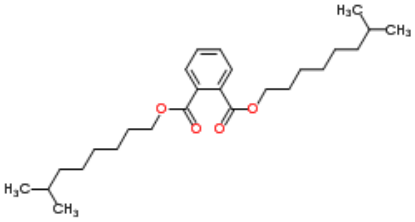
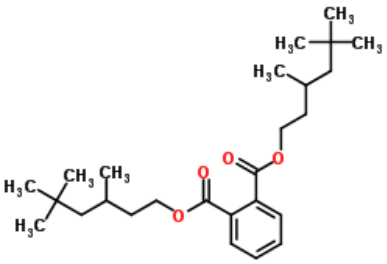
Data for the phthalate substance grouping and 14 additional phthalates

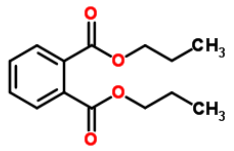
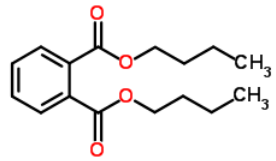
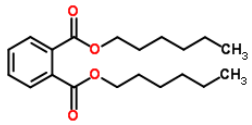
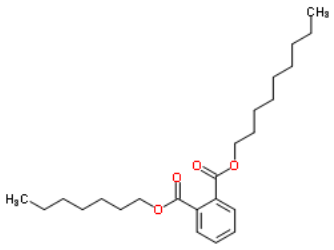
Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
DMP ** 1,2-Benzenedicarboxylic acid, dimethyl ester 	131-11-3	Short chain	Phthalate Substance Grouping
DEP ** 1,2-Benzenedicarboxylic acid, diethyl ester 	84-66-2	"	Additional phthalate considered in the evaluation of cumulative risk Personal care products, plastic and rubber materials
DCHP ** 1,2-Benzenedicarboxylic acid, dicyclohexyl ester 	84-61-7	Medium chain	Phthalate Substance Grouping
BCHP * 1,2-Benzenedicarboxylic acid, butyl cyclohexyl ester 	84-64-0	"	Phthalate Substance Grouping

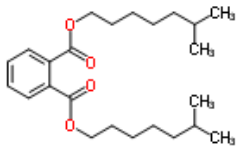
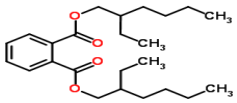
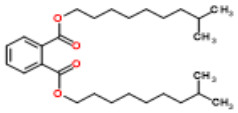
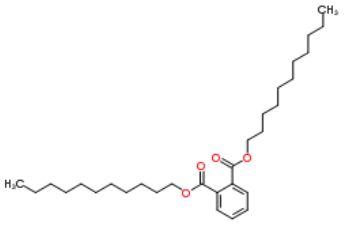
Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
DIBP ** 1,2-Benzenedicarboxylic acid, bis(2-methylpropyl) ester 	84-69-5	"	Phthalate Substance Grouping
DBzP * 1,2-Benzenedicarboxylic acid, bis(phenylmethyl) ester 	523-31-9	"	Phthalate Substance Grouping
CHIBP * 1,2-Benzenedicarboxylic acid, cyclohexyl 2-methylpropyl ester 	5334-09-8	"	Phthalate Substance Grouping

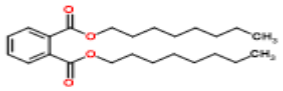
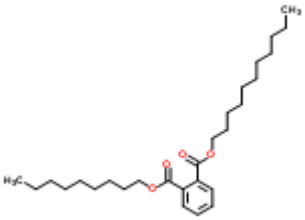
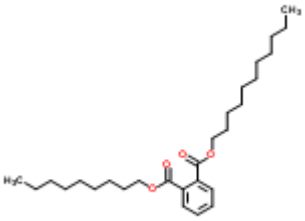
Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
B84P ** 1,2-Benzenedicarboxylic acid, 2,2-dimethyl-1-(1-methylethyl)-3-(2-methyl-1-oxopropoxy)propyl phenylmethyl ester OK https://pubchem.ncbi.nlm.nih.gov/compound/28124#section=Top 	16883-83-3	“	Phthalate Substance Grouping
BIOP * Benzenedicarboxylic acid, isooctyl phenylmethyl ester https://pubchem.ncbi.nlm.nih.gov/compound/Benzyl_2-Ethylhexyl_Phthalate#section=Top 	27215-22-1	“	Phthalate Substance Grouping
DMCHP * 1,2-Benzenedicarboxylic acid, bis(methylcyclohexyl) ester 	27987-25-3	“	Phthalate Substance Grouping

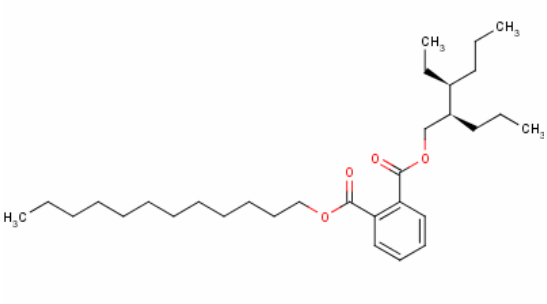
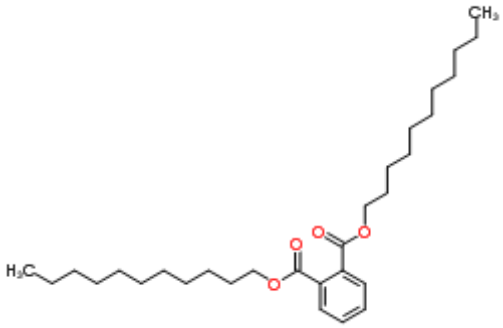
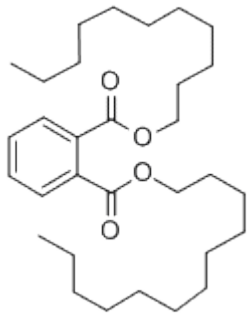
Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
B79P ** 1,2-Benzenedicarboxylic acid, benzyl C7-9-branched and linear alkyl esters https://chem.nlm.nih.gov/chemidplus/rn/68515-40-2  https://www.nicnas.gov.au/chemical-information/imap-assessments/imap-group-assessment-report?assessment_id=1178 	68515-40-2	“	Phthalate Substance Grouping Adhesives and sealants, automotive and transportation products

Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
DIHepP ** 1,2-Benzenedicarboxylic acid, di-C6-8-branched alkyl esters, C7-rich http://www.sigmaaldrich.com/catalog/product/aldrich/376671?lang=en&region=CA&gclid=EAIaIQobChMI5-jV-KmX1wIVg7fACh3TRQvpEAMYAiAAEgIhs_D_BwE 	71888-89-6	"	Phthalate Substance Grouping
DINP *** 1,2-Benzenedicarboxylic acid, di-C8-10-branched alkyl esters, C9-rich; 1,2-Benzenedicarboxylic acid, diisononyl ester  	68515-48-0 /28553-12-0	"	Phthalate Substance Grouping

Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
DPrP * 1,2-Benzenedicarboxylic acid, dipropyl ester 	131-16-8	"	Additional phthalate considered in the evaluation of cumulative risk
DBP ** 1,2-Benzenedicarboxylic acid, dibutyl ester 	84-74-2	"	Additional phthalate considered in the evaluation of cumulative risk Adhesives and sealants, paints and coatings, electrical/ electronics, building materials, printing inks, fabrics and textiles, children's toys and childcare articles, plastic and rubber materials
DnHP * 1,2-Benzenedicarboxylic acid, dihexyl ester 	84-75-3	"	Additional phthalate considered in the evaluation of cumulative risk
79P ** 1,2-Benzenedicarboxylic acid, heptyl nonyl ester, branched and linear 	111381-89-6	"	Additional phthalate considered in the evaluation of cumulative risk Plastic and rubber materials, automotive and transportation products

Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
DIOP ** 1,2-Benzenedicarboxylic acid, diisooctyl ester 	111381-89-6	"	Additional phthalate considered in the evaluation of cumulative risk
DEHP *** 1,2-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester 	117-81-7	"	Additional phthalate considered in the evaluation of cumulative risk Paints/coatings, lubricants & greases, electrical/electronics, automotive and transportation products, greases, children's toys and childcare articles, plastic and rubber materials
DIDP *** 1,2-Benzenedicarboxylic acid, diisodecyl ester 	26761-40-0 / 68515-49-1	Long chain	Phthalate Substance Grouping
DUP *** 1,2-Benzenedicarboxylic acid, diundecyl ester 	3648-20-2	"	Phthalate Substance Grouping

Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
610P ** 1,2-Benzenedicarboxylic acid, mixed decyl and hexyl and octyl diesters	68648-93-1	“	Additional phthalate considered in the evaluation of cumulative risk Automotive and transportation products, plastic and rubber materials
DnOP ** 1,2-Benzenedicarboxylic acid, dioctyl ester 	117 - 84 – 0	“	Additional phthalate considered in the evaluation of cumulative risk Electrical/ electronics, plastic and rubber materials
D911P *** 1,2-Benzenedicarboxylic acid, di-C9-11-branched and linear alkyl esters (1 structure missing) 	68515-43-5	“	Additional phthalate considered in the evaluation of cumulative risk Electrical/ electronics, automotive and transportation products, automotive and transportation products
D911P-2 ** 1,2-Benzenedicarboxylic acid, nonyl undecyl ester, branched and linear (1 structure missing) 	111381-91-0	“	Additional phthalate considered in the evaluation of cumulative risk Electrical / electronics, automotive and transportation products

Acronym, Domestic substances list name & structure	CAS RN	Chain length	Grouping & Major Uses (for some phthalates)#
DIUP *** 1,2-Benzenedicarboxylic acid, diundecyl ester http://www.chemnet.com/cas/en/85507-79-5/diundecyl-phthalate,-branched-and-linear.html  http://www.chemspider.com/Chemical-Structure.18193.html?rid=60219c77-fdcf-44c7-8873-6803ac4cf3f6 	85507-79-5	"	Additional phthalate onsidered in the evaluation of cumulative risk Electrical equipment / electronics, automotive and transportation products, plastic and rubber materials
DTDP ** 1,2-Benzenedicarboxylic acid, di-C11-14-branched alkyl esters, C13-rich http://www.chemicalbook.com/ChemicalProductProperty_EN_CB8358024.htm 	68515-47-9	"	Additional phthalate considered in the evaluation of cumulative risk Electrical/ electronics, lubricants and greases

NOTES: Used in a variety of industrial and consumer products. This does not include the amounts of these substances that are present in imported finished products/items.

Information below from 2012 data:
*** Manufactured in and/or imported into Canada in quantities greater than 10 million kg/year (7 phthalates).
** Manufactured in and/or imported into Canada in quantities between 10,000 – 1 million kg/year phthalates).
* Manufactured in and/or imported into Canada in quantities less than the threshold of 100 kg/year (7 phthalates).
# - As presented in the dSAR, information regarding phthalate substances reported to be in commerce in Canada (Environment Canada 2014); obtained from section 71 industry survey conducted under CEPA (Environment Canada 2014).