Deriving Chemicals of High Concern

Process Documentation
July 1, 2012

Environmental & Occupational Health Programs
Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor, Augusta, ME 04333
207.287.4311 ● 866.292.3474

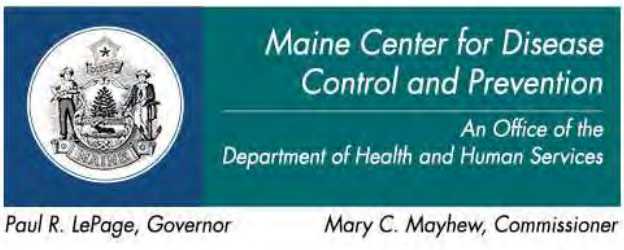


Table of Contents

I. Executive Summary

The Maine Center for Disease Control and Prevention (MECDC), in consultation with the Maine Department of Environmental Protection (MEDEP) is required by Maine Title 38, Chapter 16-D Toxic Chemicals in Children's Products to develop a list of chemicals of high concern (CHC) from an existing list of 1384 Chemicals of Concern (CC) designated to be toxic by the State of Maine. The list of CHC is not to exceed 70 chemicals. In developing the list, MECDC is directed to make a finding that there is strong credible scientific evidence that a chemical is reproductive or developmental toxicant, endocrine disruptor or human carcinogen. A finding must also be made that the chemical has been found in the human body through biomonitoring studies, present in the home environment, or present in a consumer product used or present in the home.

MECDC used as a starting point a list of 184 "Chemicals of High Concern for Children" developed by the State of Washington. Washington began with a list of over 2000 "high priority chemicals" that included all 1384 of Maine's CC. Washington then derived a separate list of over 2000 chemicals believe to have exposure potential. The intersection of these two lists yielded 476 chemicals with both toxicity and exposure information. The list of 476 was then reduced to 184 chemicals by excluding chemicals subject to overlapping regulatory initiatives, chemicals unlikely to be in consumer products, chemicals with limited toxicity data, and chemicals primarily of concern because of ecological toxicity.

MECDC followed a three step process to develop a list of Maine CHC from the Washington list of 184 chemicals: Step 1 – Identify and exclude any chemicals either not on Maine's list of 1384 chemicals of concern, already addressed by Maine or other regulatory frameworks, or unlikely to be added to consumer products; Step 2 – Identify chemicals on the list that may not meet the statutory definition of "credible scientific evidence" as defined by statute; Step 3 – Prioritize the remaining chemicals according to weight of evidence of toxicity and potential for exposure.

MECDC relied on many – though not all - of the same toxicity databases used by the state of Washington. One notable difference is that Maine statute does not authorize reliance on state databases of toxicity. MECDC applied a similar prioritizing scheme as Washington (e.g., including only carcinogens known to cause cancer in humans). MECDC and MEDEP worked collaboratively to update and expand Washington's assessment of exposure potential for candidate CHC. This included performing literature searches to obtain more data about presence of chemicals in the human body, indoor air, or household dust. It also included evaluating an expanded list of national and international databases to identify chemicals in consumer products.

The final list of Chemicals of High Concern consists of 49 chemicals. The majority of these chemicals are on the list either because they are known human carcinogens or endocrine disruptors. Nearly two-thirds of these chemicals had information indicating their presence in human body.

II. Introduction

Maine Title 38, Chapter 16-D Toxic Chemicals in Children's Products[1] requires the Maine Center for Disease Control (MECDC) to develop a list of chemicals of high concern (CHC) by July 1, 2012, in consultation with the Maine Department of Environmental Protection (MEDEP).

This list is to consist of no more than 70 chemicals. The list is to be based on "credible scientific evidence," defined in the statute "as the results of a study, the experimental design and conduct of which have undergone independent scientific peer review, that are published in a peer-reviewed journal or publication of an authoritative federal or international governmental agency, including but not limited to the United States Department of Health and Human Services, National Toxicology Program, Food and Drug Administration and Centers for Disease Control and Prevention; the United States Environmental Protection Agency; the World Health Organization; and the European Union, European Chemicals Agency." Note that authoritative lists are to be national or international (not state), and that peer-reviewed studies may also be considered in determining whether a chemical meets the criteria for "credible scientific evidence."

§1693 –A. Identification of chemicals of high concern

1. List. By July 1, 2012, the department shall publish a list of no more than 70 chemicals of high concern. The Department of Health and Human Services, Maine Center for Disease Control and Prevention, in consultation with the department, shall develop the list. To be listed as a chemical of high concern, a chemical must be on the list of chemicals of concern pursuant to section 1693 and meet the eligibility criteria of subsection 2.

2. Criteria. A chemical of concern on the list of chemicals of concern pursuant to section 1693 may be included in the list published pursuant to subsection 1 if the department, in concurrence with the Department of Health and Human Services, Maine Center for Disease Control and Prevention, determines that there is strong credible scientific evidence that the chemical is reproductive or developmental toxicant, endocrine disruptor or human carcinogen, and there is strong credible scientific evidence that the chemical meets one or more of the following criteria:

   a. The chemical has been found through biomonitoring studies to be present in human blood, human breast milk, human urine or other bodily tissues or fluids;

   b. The chemical has been found through sampling and analysis to be present in household dust, indoor air or drinking water or elsewhere in the home environment; or

   c. The chemical has been added to or is present in a consumer product used or present in the home.

The toxicity criteria used to develop the list are that there is strong credible scientific evidence that the chemical is a developmental or reproductive toxicant, endocrine disruptor, or human carcinogen. Further, there must be strong credible scientific evidence of one of the following exposure criteria: the chemical is present in the human body based on biomonitoring studies; it has been found to be present in household dust, indoor air, or drinking water based on sampling; it has been added or is present in a consumer product used or present in the home. The sources used for deriving the list of 70 or fewer chemicals were chosen to comply with these criteria.

[1] http://www.mainelegislature.org/legis/statutes/38/title38sec1693-A.html

III. Starting Point for the MECDC Process: The State of Washington List of Potential Chemicals of High Concern for Children

The State of Washington passed **Chapter 70.240 RCW Children's Safer Products**[2] that in part required the state to develop a list of high priority chemicals to which children may be exposed. The State of Washington, through a publicly-reviewed process, first developed a list of 184 chemicals determined to have both toxicity and exposure information (referred to as Phase 1 assessment), referred to as a list of potential chemicals of high concern for children. These 184 chemicals then underwent further evaluation by a second set of criteria (referred to as Phase 2) to develop a prioritize list of 66 chemicals subject to reporting requirements.

MECDC has accepted the Phase 1 assessment carried out by the State of Washington as the starting point for Maine's prioritizing process to identify up to 70 chemicals of high concern (CHC). Washington's Phase 1 process is briefly summarized below and in Figure 1. For more information, visit the State of Washington's website where documents describing their process can be viewed.[3]

Washington began by assembling a list of "high priority chemicals" (HPC) defined by statute to have met one or more of the following criteria.[4]

(a) Harm the normal development of a fetus or child or cause other developmental toxicity

(b) Cause cancer, genetic damage, or reproductive harm

(c) Disrupt the endocrine system

(d) Damage the nervous system, immune system, or organs or cause other systemic toxicity

(e) Be persistent, bioaccumulative, and toxic

(f) Be very persistent and very bioaccumulative

In compiling their list of HPC chemicals, Washington relied upon the authoritative work of governmental agencies as the primary source of information, much as Maine did in compiling its list of "chemicals of concern". Because government sources identifying neurotoxicants are not

---

[2] http://apps.leg.wa.gov/RCW/default.aspx?cite=70.240&full=true

[3] http://www.ecy.wa.gov/programs/swfa/rules/ruleChildPilotPhase.html . Also see: A Stone and D Delistraty, Sources of toxicity and exposure information for identifying chemicals of high concern to children, *Environmental Impact Assessment Review*, 30: 380-387, 2010

[4] These criteria are very similar to those required under Maine law for developing a list of "chemicals of concern". A chemical may be included on the list of chemicals of concern only if it has been identified by an authoritative governmental entity on the basis of credible scientific evidence as being: A. A carcinogen, a reproductive or developmental toxicant or an endocrine disruptor; B. Persistent, bioaccumulative and toxic; or C. Very persistent and very bioaccumulative (38 MRSA §1693)

available, Washington turned to scientific peer-reviewed literature as well. Through this process, Washington compiled a list of over 2044 chemicals from these sources that could be assigned a unique CAS registration number, a list that includes all 1380 chemicals on Maine's list of chemicals of concern.

In a parallel effort, Washington also compiled a list of chemicals with evidence of having been found in humans or that have a potential exposure route to children. The potential for exposure was considered established if a chemical met one or more of the flowing criteria.

(a) The chemical has been found through biomonitoring studies that demonstrate the presence of the chemical in human umbilical cord blood, breast milk, urine, or other bodily tissues or fluids.

(b) The chemical has been found through sampling and analysis to be present in household dust, indoor air, drinking water, or elsewhere in the home environment.

(c) The chemical has been added to or is present in a consumer product used or present in the home.

Data published both by authoritative governmental agencies and in peer reviewed scientific literature were considered by Washington in compiling the list of chemicals with exposure potential. Table 2 below, reproduced from the State of Washington Phase 1 report summarizes the major sources of authoritative governmental exposure information.

Table 1: Authoritative sources to identify exposure potential

Area	Authoritative Sources
Biomonitoring	Centers for Disease Control and Prevention (CDC) – National Health and Nutrition Examination Survey (NHANES)
	Danish Birth Cohort
Indoor Air and Dust	California Air Resources Board
Drinking Water	EPA Drinking Water Program
Consumer Products	Danish EPA
	Dutch Government

Washington expanded its search for data on the above by including chemicals identified in studies published in three peer-reviewed scientific journals searched using a set of specified keywords:

- Environmental Science and Technology: http://pubs.acs.org/search/advanced
- Environmental Health Perspectives: http://www.ehponline.org/
- Toxicological Sciences: http://toxsci.oxfordjournals.org/search.dtl

Through this process, about 2219 chemicals were identified as having the potential for exposure and a unique CAS registration number. Washington next identified those chemicals common to both their lists of "chemicals of high concern" and those with exposure potential, resulting in a list of 476 chemicals referred to as "potential chemicals of high concern for children" (CHCCs). Washington then excluded potential CHCCs they believed were already sufficiently addressed by overlapping regulatory frameworks, chemicals unlikely to be added to children's products because they were combustion products, emerging chemicals with only limited toxicity data, and chemicals of concern primarily due to their ecological (as opposed to human) toxicity. These decisions reduced Washington's list of potential CHCCs from 476 to 184 chemicals. These 184 chemicals are listed in Appendices 10A and 10B of their supporting documents and other accompanying appendices provide documentation of selection criteria and chemicals excluded.[3]

There were several reasons MECDC chose not to adopt the Washington's Phase 2 process used to develop a final prioritize list of 66 chemicals. Maine's authorizing law has certain requirements that differ in some important ways from Washington (e.g., Maine's law did not authorize reliance on state government lists of chemicals under its definition of credible scientific information). Maine's list of chemicals of concern is a subset of the Washington's list of CHC. Washington's consideration of overlapping regulatory frameworks did not consider any Maine specific regulations. Additionally, Washington's literature search for biomonitoring and other exposure potential data and its assessment of chemicals in products were now dated. Yet there were elements of Washington's Phase 2 process that Maine did decide to adopt; such as a prioritizing of chemicals based on a higher weight of evidence that a chemical was toxic to humans (e.g., a known human carcinogen; clear or some evidence a chemical was a reproductive or developmental toxicant). For more information on Washington's Phase 2 process, visit the State of Washington's website where documents describing their process can be viewed.[3]

Figure 1: Washington State Chemicals of High Concern for Children Identification Process

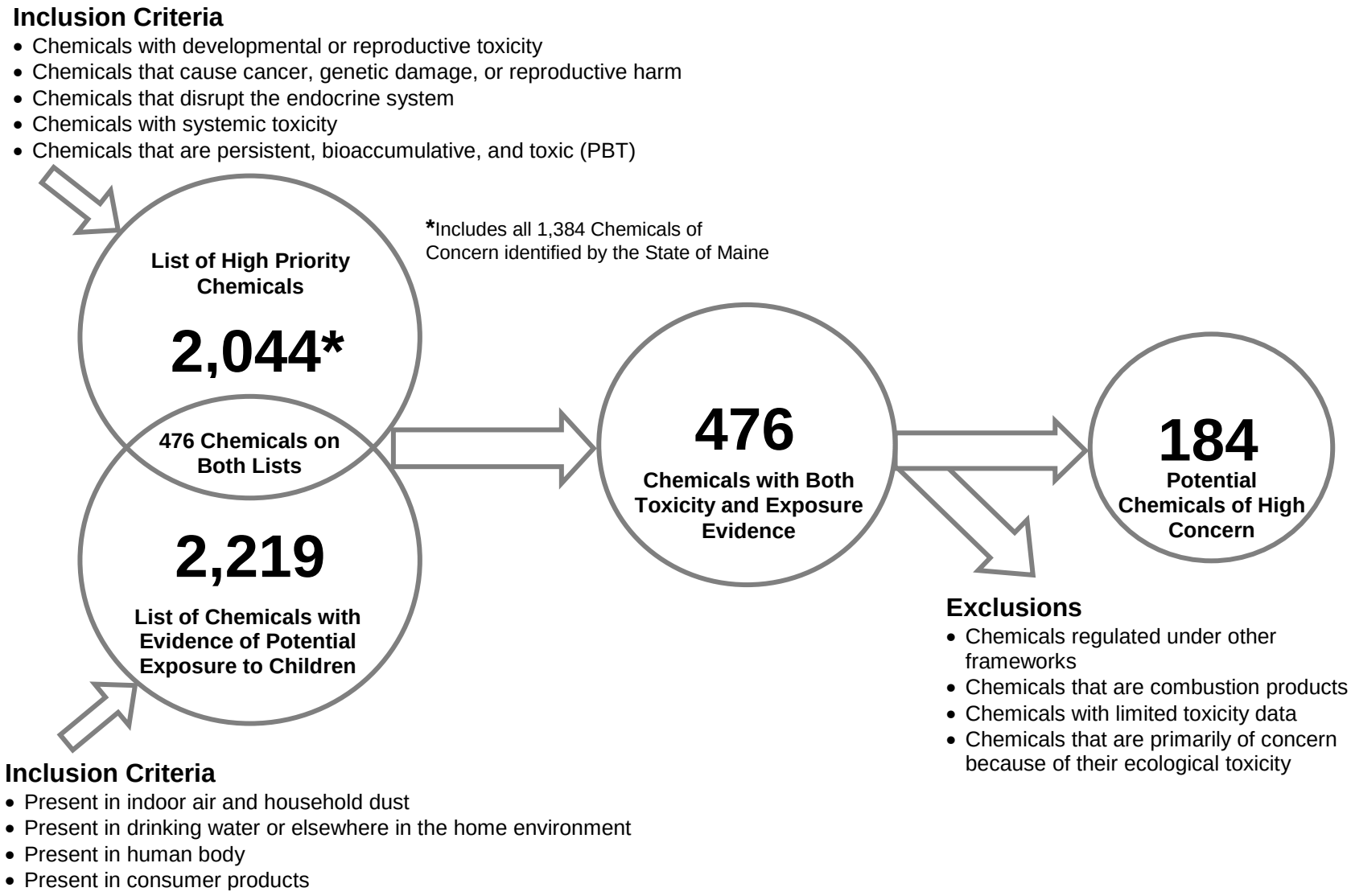
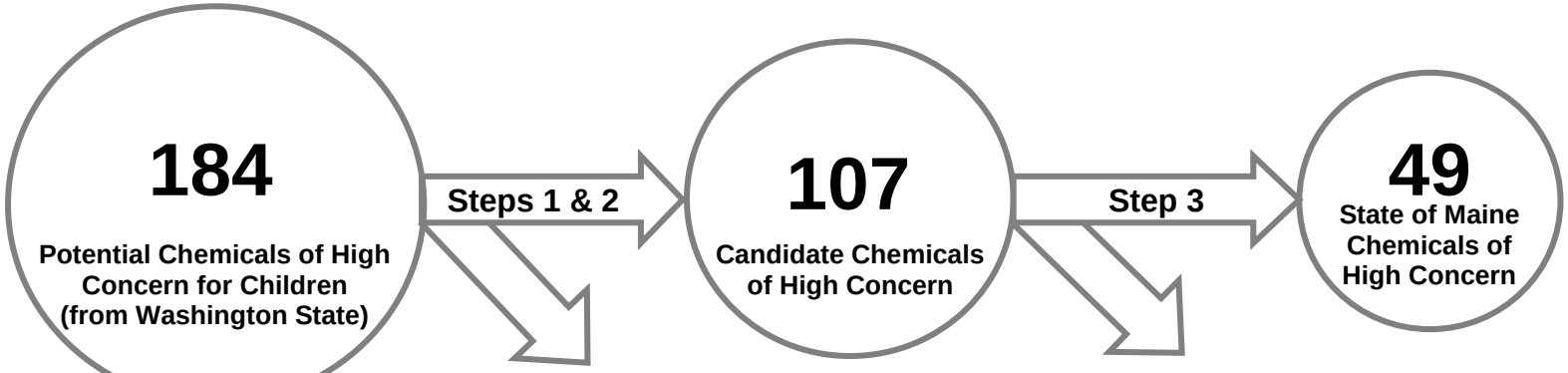


Figure 2: State of Maine Chemicals of High Concern for Children Prioritization Process



Steps 1 & 2 Exclusions

- Chemicals not on list of 1,384 Maine Chemicals of Concern
- Chemicals that are regulated by other frameworks
- Chemicals unlikely to be added to consumer products
- Chemicals only on California's Prop 65 list of carcinogens or reproductive/ developmental toxicants and no other authoritative lists

Step 3 Exclusions

- Chemicals only on Reprotext listing
- Chemicals with low toxicity values from U.S. EPA's IRIS data base
- Carcinogens from authoritative lists not listed as "known human carcinogen"
- Chemicals only on list of NTP reproductive or developmental toxicants without either "clear" or "some" evidence of adverse effects
- European Union category 2 endocrine disruptors
- Chemicals that do not meet State of Maine exposure criteria

IV. MECDC Process to Identify Chemicals of High Concern

Starting with Washington's list of 184 chemicals, MECDC conducted a three step process to meet the statutory mandate of identifying a list of Chemicals of High Concern consisting of 70 or fewer chemicals (Figure 2).

Step 1 – Identify and exclude any chemicals either not on Maine's list of 1380 chemicals of concern, already addressed by Maine or other regulatory frameworks, or unlikely to be added to consumer products;

Step 2 – Identify chemicals on the list that may not meet the statutory definition of "credible scientific evidence" and either exclude such chemicals or otherwise determine there is sufficient peer review literature to retain the chemical;

Step 3 – Prioritize the remaining chemicals according to weight of evidence of toxicity and potential for exposure.

A. Step 1 – Identify and exclude chemicals not on Maine's list of CC, already addressed by other regulatory frameworks, and unlikely to be added to consumer products.

MECDC identified 53 chemicals that were on the Washington list of 184 but not on the Maine list of CC (Table 2). These chemicals were excluded from further consideration.

Table 2: Chemicals not on the Maine CC list

57-55-6 Propylene glycol	101-68-8 Mono-/polymeric MDI	624-83-9 Methyl isocyanate
57-63-6 17-ethylnyestradiol	107-21-1 Ethylene glycol	822-06-0 Hexamethylene diisocyanate
60-29-7 Diethyl ether	108-91-8 Cyclohexylamine	7439-98-7 Molybdenum
64-18-6 Formic Acid	108-95-2 Phenol	7440-14-4 Radium
65-85-0 Benzoic acid	121-44-8 Triethylamine	7440-22-4 Silver compounds
71-36-3 n-Butanol	123-38-6 Propionaldehyde	7440-24-6 Strontium compounds
75-44-5 Phosgene	124-40-3 Dimethylamine	7440-36-0 Antimony compounds
75-60-5 Dimethylarsenic acid	131-11-3 Dimethyl phthalate	7440-42-8 Boron compounds
75-69-4 Trichlorofluromethane	137-17-7 Trimethylaniline	7440-40-8 Copper compounds
75-71-8 Dichlorodifluoromethane	142-82-5 n-Heptane	7440-61-1 Uranium compounds
76-13-1 Trichloro-trifluoroethane	142-83-6 Hexadienal	7647-01-0 Hydrochloric acid
78-83-1 Isobutyl alcohol	143-22-6 Triethylene glycol	7782-41-4 Fluorine
78-93-3 Methyl ethyl ketone	149-57-5 Ethylhexanoic acid	10049-04-4 Chlorine dioxide
85-44-9 Phthalic anhydride	156-59-2 Dichloroethylene	10102-43-9 Nitric oxide
92-52-4 Biphenyl	156-60-5 Trans-dichloroethylene	10102-44-0 Nitrogen dioxide
95-50-1 Dichlorobenzene	463-58-1 Carbonyl sulfide	14859-67-7 Radon 222
96-33-3 Methyl acrylate	506-77-4 Cyanogen chloride	28553-12-0 DiNP
98-86-2 Acetophenone	540-84-1 Trimethylpentane	

Five additional chemicals were eliminated based on a determination that there were other overlapping regulatory frameworks, with several already identified as a Maine priority chemical and one already regulated by federal and state laws (Table 3).

Table 3: Chemicals eliminated because of overlapping regulatory framework

64-17-5	ethanol: ingested voluntarily, regulated by FDA
80-05-7	BPA: Maine priority chemical
104-40-5	4-nonylphenol: Maine priority chemical
9016-45-9	nonylphenolethoxylate: Maine priority chemical
25154-52-3	nonylphenol: Maine priority chemical

Four chemicals were eliminated because they were viewed as unlikely to be added to consumer products (Table 4).

Table 4: Chemicals eliminated because unlikely to be added to consumer products

55-16-7 estrone: natural hormone
4376-20-9 Mono-2-ethyl hexylphthalate or MEHP: a mammalian metabolite of DEHP.[5]
22967-92-6 methylmercury: not added to products, included in 7439-97-6
64742-48-9 crude oil: unlikely to be added to a product in the home

B. Step 2 – Identify chemicals on the list that may not meet the statutory definition of "credible scientific evidence."

Maine law defines "credible scientific evidence" as " the results of a study, the experimental design and conduct of which have undergone independent scientific peer review, that are published in a peer-reviewed journal or publication of an authoritative federal or international governmental agency, including but not limited to the United States Department of Health and Human Services, National Toxicology Program, Food and Drug Administration and Centers for Disease Control and Prevention; the United States Environmental Protection Agency; the World Health Organization; and the European Union, European Chemicals Agency."

State agencies were not included in this definition, yet there are a number of chemicals included on the Washington list of 184 chemicals only on the basis of inclusion on an authoritative state government list. This includes chemicals on the California Prop 65 lists either as carcinogens or as reproductive and developmental toxicants. It also includes chemicals on Washington's list of persistant bioaccumulative toxins (PBTs). Chemicals on these state lists were therefore evaluated as to whether they should be excluded.

[5] Mono-2-ethyl hexylphthalate or MEHP is a mammalian metabolite of DEHP: a compound already regulated under the federal CSPIA. http://www.ecy.wa.gov/programs/swfa/rules/pdf/p3doh.pdf

1. Chemicals on the California Proposition 65 list of carcinogens

Chemicals that were on the Prop 65 list as carcinogens, but were not on any of the national and international governmental carcinogen lists (i.e., IARC, NTP, or EPA) were excluded. Maine law does not recognize state databases as "credible scientific evidence". There are three separate authoritative national / international lists of carcinogens available for consideration. Washington also excluded Prop65 carcinogens in their Phase 2 assessment. The 17 chemicals excluded for this reason are listed in Table 5. All of these chemicals can be expected to have peer reviewed publications to support their classification of carcinogens by California. However a review of this peer reviewed literature was considered outside the scope of this current screening effort.

Table 5: Chemicals listed by the State of Washington as toxicants only on the CA PROP65 list as carcinogens

59-89-2 N-nitrosomorpholine	139-65-1 4,4'-thiobsbenzenamine
62-56-6 thiourea	140-82-5 heptane
84-65-1 anthraquinone	140-88-5 ethyl acrylate
93-15-2 methyleuganol	615-05-4 2,4-diaminoanisole
94-59-7 safrole	838-88-0 4,4'-methylene bis(methylanaline)
96-13-9 2,3-dibromo-1-propanol	1333-86-4 carbon black
97-56-3 o-aminoazotoluene	29082-74-4 octachlorostyrene
101-77-9 4,4'-diaminodipehnylmenthane	77439-76-0 3-chloro-4(dichloromethyl)-5-hydroxy-2(5H)-furanone
120-71-8 p-cresidene	

An exception was the chemical tris (2-chloroethyl) phosphate (TCEP, CAS# 115-96-8). TCEP is listed as a carcinogen under Proposition 65, but was retained because the Canadian Environmental Protection Act (CEPA) proposes to limit TCEP in products intended for children under 3 years of age under the Hazardous Products Act.[6] The Canadian government's screening assessment report published in August 2009 concluded TCEP may pose a danger to human life or health as it is a carcinogen for which there may be a probability of harm at any level of exposure and it may cause impaired fertility in males. Infants from 0-6 months old were the population with potentially the highest consumer product exposure estimates, resulting from mouthing of polyurethane foam cushioning[7].

2. Chemicals on the California Proposition 65 list for reproductive or developmental toxicants

MECDC excluded chemicals that appeared solely on Washington's list of potential CHCC because they were on the California Prop 65 list for reproductive and developmental toxicants.

[6] http://www.hc-sc.gc.ca/cps-spc/legislation/consultation/_2010tris_phosphate/index-eng.php

[7] http://www.ec.gc.ca/substances/ese/eng/challenge/batch5/batch5_115-96-8.cfm

The rationale was similar to that of Prop 65 carcinogens; it is a State list and there already exists both a national (National Toxicology Program) and international authoritative governmental lists for reproductive and developmental toxicants (UN Globally Harmonized System of Classification and Labeling of Chemicals). Six chemicals were excluded based on this decision (Table 6). All of these chemicals likely have peer reviewed publications to support their classification of reproductive or developmental hazards by California. However a review of this peer reviewed literature was considered outside the scope of this current screening effort.

Table 6: Chemicals listed by the State of Washington as toxicants only because on the CA PROP65 list as reproductive or developmental toxicants

75-15-0 carbon disulfide	872-50-4 n-methylpyrrolidone (NMP)
84-75-3 di-*n*-hexyl phthalate (DnHP)	109-86-4 methoxyethanol
149-50-4 2-ethylhexanoic acid (2-EHA)	110-80-5 ethylene glycol monoethyl ether

3. Chemicals on the Washington PBT list

Persistent, bioaccumulative toxins (PBTs) are chemicals that are believed to represent a unique threat to human health and the environment, because they remain in the environment for long periods of time, are hazardous to the health of humans and wildlife, can build up in the food chain, and can be transported long distances and readily move between air, land and water media. Maine law clearly established persistent and bioaccumulative and toxic as criteria to be used in identifying chemicals of concern, yet MECDC could identify only one national / international governmental agency with a list of PBTs (Canada's). Several chemicals on the Washington PBT list are chemicals that MECDC has previously undertaken extensive reviews of the scientific literature, in support of regulatory initiatives in Maine. These chemicals are listed below and were retained as potential candidates for CHC based on MECDC's determination that there is credible scientific evidence to support their inclusion.

(CAS# 79-94-7) tetrabromobisphenyl A (TBBPA) A review by the Maine CDC identified about two dozen studies documenting effects on reproductive, developmental, endocrine, or cancer endpoints. Studies were also identified with data on levels of TBBPA in humans.[8]

(CAS# 1163-19-5) deca brominated diphenyl ether (deca BDE) Reports to the Maine legislature by the MEDEP and MECDC reviewed numerous studies documenting adverse endocrine and

[8] Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Brominated Flame Retardants as a Priority Chemical, November 22, 2010

developmental effects of deca BDE, including effects on thyroid hormones and developmental neurotoxicity.[9]

(CAS# 25637-99-4) hexabromocyclododecane (HBCD). Maine CDC documents peer-reviewed studies reporting endocrine and developmental effects of HBCD, including developmental neurotoxicity in humans. Studies were also identified with data on levels of TBBPA in humans.[10] It is also noteworthy that the US EPA has an action plan for HBCD based on concerns for reproductive, developmental, and neurological effects.[11]

(CAS # 1763-23-1) perfluorooctanyl sulfuric acid and its salts (PFOS). MECDC is currently performing an assessment of the peer reviewed literature of PFOS in support of developing a maximum exposure guideline for drinking water. As part of this review, a recent scientific publication was identified that reported serum levels perfluorooctane sulfonate were positively associated with chronic kidney disease.[12] The authors examined the relation of serum PFOS (and PFOA) and chronic kidney disease in 4,587 adult participants from combined National Health and Nutritional Examination Surveys for whom serum measurements were available. Compared with subjects in the first quartile of serum level (referent), the multivariable odds ratio for chronic kidney disease among subjects in fourth quartile of serum levels of PFOS was 1.82 (95% confidence interval: 1.01, 3.27; P for trend = 0.019). The association was independent of confounders such as age, sex, race/ethnicity, body mass index, diabetes, hypertension, and serum cholesterol level. It is also noteworthy that the European Union designates PFOS as persisitent, bioaccumulative, and toxic to mammalian species, and recommends ultimate phase-out.[13]

---

[9] Brominated Flame Retardants: A Report to the Joint Standing Committee on Natural Resources, 122nd Maine Legislature, Prepared by: Maine Bureau of Health (now the Maine Center for Disease Control and Prevention) and the Maine Department of Environmental Protection, February 2005. Brominated Flame Retardants: A report to the Committee on Natural Resources, 122nd Maine Legislature, Prepared by the Center for Disease Control and Prevention and Department of Environmental Protection, February 2006. Brominated Flame Retardants: Third annual report to the Maine Legislature, Prepared by the Maine Center for Disease Control & Prevention and the Maine Department of Environmental Protection, January 2007.

[10] Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Brominated Flame Retardants as a Priority Chemical, November 22, 2010

[11] http://www.epa.gov/existingchemicals/pubs/actionplans/hbcd.html.

[12] Shankar, Anoop; Jie Xiao and Alan Ducatman (2011-10-15). "Perfluoroalkyl Chemicals and Chronic Kidney Disease in US Adults". American Journal of Epidemiology 174 (8): 893–900.

[13] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0032:0034:en:PDF

C. Step 3 – Prioritize the remaining chemicals according to weight of evidence of toxicity and potential for exposure.

After the completion of Step 2, Washington's list of 184 chemicals was reduced to 101 chemicals. MECDC then implemented a prioritizing scheme similar to that undertaken by Washington in its Phase 2 prioritizing process, but with some differences with respect to toxicity databases considered, and more inclusive and up to date with respect to exposure databases.

1. Toxicity criteria used for prioritizing

A number of authoritative lists were considered by the MECDC to prioritize the remaining potential chemicals of high concern in order of toxicity. These databases are listed in Table 8. MECDC dropped the following two databases relied on by Washington in their prioritizing process.

- Reprotext is a non-government database owned by Reuters. It requires a subscription to access. It consists of evaluations of about 850 chemicals with respect to characteristics and uses of each chemical, as well as reviews of general and reproductive toxicity. A grading system indicating degree of hazard is included. Reviews are done by an expert reproductive and developmental toxicologist, with no peer review. Designation in Category A+ (human reproductive hazard with no known no-effect level) or A (human reproductive hazard with known no-effect dose) were the inclusion criteria by the State of Washington in their Phase 2 assessment. MECDC did not use this database as a means of prioritizing chemicals in part out of concern as to whether it met the statutory definition of credible scientific evidence, and lack of access to this database. Two chemicals were excluded for this reason: Aniline (CAS #62-53-3) and methylene chloride (CAS# 75-09-2).
- Washington included a number of reproductive and development chemicals with low toxicity values identified from databases maintained by either the U.S. Agency for Toxic Substances and Disease Registry (ATSDR) or CDC / NIOSH Registry of Toxic Effects of Chemical Substances (RTECs). The stated purpose was to identify chemicals with developmental or reproductive toxicity that are not on the authoritative lists, especially chemicals with newer information in this toxicity endpoint. While laudable in intent, Maine's definition of credible scientific evidence emphasizes the use of either published peer-reviewed journals articles or lists compiled by authoritative federal or international governmental agency. Consequently, chemicals on the list of 184 chemicals solely on the basis of a low toxicity value were excluded. Sixteen chemicals were excluded for this reason (Table 7).

Table 7: Chemicals listed by the State of Washington only due to low toxicity values

67-56-1 Methanol	100-41-4 Ethylbenzene
74-87-3 Methyl chloride	100-52-7 Benzaldehyde
75-00-3 Chloroethane; Ethyl chloride	106-47-8 para-Chloroaniline
78-87-5 1,2-Dichloropropane	107-13-1 Acrylonitrile
79-01-6 Trichloroethylene	110-86-1 Pyridine
79-06-1 Acrylamide	119-93-7 3,3´-Dimethylbenzidine
95-80-7 2,4-Diaminotoluene	127-18-4 Perchloroethylene
96-18-4 1,2,3-Trichloropropane	26471-62-5 Toluene diisocyanate; TDI

Table 8: Databases and associated prioritizing criteria used by MECDC in prioritizing toxicity

DATA BASE	PRIORITIZING CRITERIA
National Toxicology Program Center for Evaluation of Risks to Human Reproduction (NTP CERHR)	"Clear" or "Some" evidence of adverse effect in humans
National Toxicology Program Report of Carcinogens	Known human carcinogen
Globally Harmonized System of Classification and Labelling of Chemicals (GHS)	Category 1A reproductive hazard Category 1 carcinogen
European Commission (EC) Endocrine Disruptor Program	Category 1 endocrine disruptor
Canadian PBiT	Present on list
Washington PBT	Present on list and confirmed with review of studies published in peer reviewed publications
U.S. Environmental Protection Agency Integrated Risk Information System (IRIS)	1986 category A, 1996, 1999, or 2005 known human carcinogen
European Union List of Carcinogens	Category 1A carcinogen
International Agency for Research of Cancer (IARC)	Category 1

Detailed description of these databases can be found at the end of this document.

For the remaining databases, MECDC applied criteria fairly similar to those used by Washington in their Phase 2 assessment as follows.

- For chemicals identified as a carcinogen on an authoritative national or international government list, MECDC only included those classified as known human carcinogens or a similar level of evidence of carcinogenicity in humans (i.e., Category A, Category 1 carcinogens). Thus, chemicals classified as either an IARC 2a, or IRIS 86 B1, B2 or C carcinogens were excluded.

- For chemicals that were on the Washington list because they were listed by NTP as reproductive or developmental toxicants, MECDC only included those classified as having "clear evidence of adverse effects in humans" or "some evidence of adverse effects in humans". Chemicals not meeting this criterion were excluded.

- Chemicals identified as endocrine disruptors by the European Union were included if they were classified as Category 1 (evidence of endocrine disrupting activity in at least one species using intact animals), and excluded if Category 2 (at least some *in vitro* evidence of biological activity related to endocrine disruption).

2. Exposure criteria used for prioritizing

MECDC sought to both update and expand the search of published peer reviewed studies identifying chemicals present in biomonitoring studies and indoor air and dust. Washington gathered biomonitoring, drinking water, and indoor air and dust data from three scientific journals: *Environmental Health Perspectives*, *Environmental Science and Technology*, and *Toxicological Sciences*. In addition, biomonitoring results from the 2005 CDC NHANES study, which is representative of the US population, were included. For indoor air and dust, several reports from the California Air Bureau were also sources for exposure data. Only the 2005 report to the legislature was peer-reviewed, and so eligible to be considered by MECDC. MECDC updated the search of published peer reviewed studies identifying chemicals present in biomonitoring studies and indoor air and dust by searching for papers in recent years, and additionally expanded the journals searched to include all accessible through a PubMed search using search terms similar to those used by Washington and described at the end of this report. The publications found through this literature search are listed in Appendix IV.

The Maine Department of Environmental Protection (MEDEP) assumed responsibility for revisited databases evaluated by Washington for presence of chemicals in consumer products both to look for updates since Washington last evaluated them and to expand to allow for a broader inclusion of types of consumer products (Washington's law requires more focus on children's products). MEDEP additionally expanded the set of databases evaluated based on references identifying chemical compounds within consumer products were identified through the Washington process documents, chemical score sheets, and published spreadsheets outlining their exposure research efforts.

Table 9 lists product related databases used by MEDEP/MECDC to evaluate evidence of exposure to chemicals and viewed as permissible under Maine's definition of credible scientific evidence. A description of these databases and links to them are provided in the addendum to this report. A more complete description of the process used by MEDEP and associated databases and literature search is presented in Appendix V.

Table 9: Criteria used by MECDC/MEDEP as evidence of potential exposure

Danish and Dutch Environmental Protection Agency (DEPA) studies and reports	National Library of Medicine Hazardous Substances Data Bank (HSDB)
European chemical Substances Information System (ESIS) Risk Assessment Reports	National Library of Medicine Household Products Database (HPD)
Netherlands Food and Consumer Product Safety Authority (NL)	U.S. Environmental Protection Agency (EPA) Inventory Use and Reporting Database (IUR)
German Environmental Protection Agency	U.S. EPA Chemical Assessment and Management Program (ChAMP)
2012 ToSCA Work Plan for Consumer Products	U.S. EPA Voluntary Children's Chemical Evaluation Program (VCCEP)

Although not used for purposes of prioritizing, MECDC included information compiled by State of Washington regarding whether their priority chemicals were likely to be released into air, ingested by the child, or come in contact with skin for potential future use.

3. Application of Prioritizing Criteria

The list of 107 chemicals that went through the prioritization process were compiled into a table with separate columns for each toxicity exposure related database considered, and rows for each chemical (see Appendix I). Check boxes were used to denote that a chemical met the prioritizing scheme for toxicity (e.g., known human carcinogen, clear or some evidence of toxic effects in humans for developmental/reproductive toxicants). Cells left empty either do not meet the prioritizing criteria above, or do not have any information for that data source. Cells on the exposure section similarly use checks to indicate that a chemical was reported present in consumer products. For columns labeled biomonitoring and indoor air or household dust, a number is provided indicating the number of peer-reviewed journal articles identified through MECDC's literature search (e.g., number of biomonitoring papers with reference to a chemical being found in human tissue, number of governmental reports indicate a chemical present in a consumer product). Chemicals excluded based on the prioritizing scheme are identifiable as shaded rows.

The final prioritized list of CHC consists of 49 chemicals. A list of 49 CHC is provided in Table 10 with supporting information of results from applying prioritizing scheme tabulated in Appendix II and an accompanying narrative in Appendix III. The majority of listed chemicals were prioritized based on being either known human carcinogens or European Union Category 1 endocrine disruptors. Biomonitoring data indicating presence in the human body was identified for 30 chemicals, and 28 chemicals were identified as having been detected in indoor air or dust. Only five chemicals were excluded for lack of exposure information.

There is considerable overlap between Maine's list of Chemicals of High Concern and Washington's final list of Chemicals of High Concern for Children (66 chemicals). The two lists share 33 chemicals in common.

Table 10: List of Chemicals of High Concern

CAS	Chemical
50-00-0	Formaldehyde
71-43-2	Benzene
75-01-4	Vinyl chloride
79-94-7	Tetrabromobisphenol A
84-61-7	Dicyclohexyl phthalate; DCHP
84-66-2	Diethyl phthalate
84-74-2	DBP (Dibutyl phthalates); di-n-butyl phthalate
84-75-3	Di-n-Hexyl Phthalate
85-68-7	BzBP; Benzyl butyl phthalate; Butyl benzyl phthalate; BBzP
87-68-3	Hexachlorobutadiene
91-59-8	2-Naphthylamine
92-69-3	4-Hydroxybiphenyl; 4-Phenylphenol
92-87-5	Benzidine and its salts
94-13-3	Propyl paraben
94-26-8	Butyl paraben
95-53-4	2-Aminotoluene
99-76-3	Methyl paraben
99-96-7	p-Hydroxybenzoic acid
100-42-5	Styrene
101-14-4	4,4´-Methylenebis(2-Chloroaniline)
106-89-8	Epichlorohydrin
106-93-4	1,2-Dibromoethane
106-99-0	1,3-Butadiene
108-88-3	Toluene
115-96-8	Tris(2-chloroethyl) phosphate
117-81-7	DEHP (Di-(2-ethylhexyl) phthalate); bis(2-ethylhexyl) phthalate

118-74-1	Hexachlorobenzene
120-47-8	Ethyl paraben
131-55-5	Benzophenone-2 (Bp-2), 2,2',4,4'-tetrahydroxybenzophenone
131-56-6	2,4-Dihydroxybenzophenon; Resbenzophenone
131-70-4	Mono-n-butylphthalate
140-66-9	4-tert-Octylphenol; 1,1,3,3-Tetramethyl-4-butylphenol
556-67-2	Octamethylcyclotetrasiloxane
608-93-5	Benzene, pentachloro-
1163-19-5	2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether; BDE-209
1634-04-4	Methyl tert-butyl ether; MTBE
1763-23-1	Perfluorooctanyl sulphonic acid and its salts; PFOS
1806-26-4	Phenol, 4-octyl-
2425-85-6	2-Naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]-
5466-77-3	2-ethyl-hexyl-4-methoxycinnamate
7439-97-6	Mercury & mercury compounds
7440-02-0	Nickel & nickel compounds
7440-38-2	Arsenic & Arsenic compounds
7440-41-7	Beryllium & Beryllium compounds
7440-43-9	Cadmium
14808-60-7	Quartz
25013-16-5	Butylated hydroxyanisole
25637-99-4	Hexabromocyclododecane
27193-28-8	Phenol, (1,1,3,3-tetramethylbutyl)-; Octylphenol

V. Description databases relied on in developing a list of Chemicals of High Concern

A. Toxicity databases

National Toxicology Program Center for the Evaluation of Risks to Human Reproduction
The National Toxicology Program (NTP) is an interagency program managed by the US Department of Health and Human Services (DHHS) whose mission is to evaluate agents of public health concern by developing and applying tools of modern toxicology and molecular biology. The NTP Center for the Evaluation of Risks to Human Reproduction (CERHR) was established in 1998 to serve as an environmental health resource to the public and regulatory and health agencies. CERHR publishes monographs that assess evidence that environmental chemicals, physical substances, or mixtures that cause adverse effects on reproduction and development and provides opinion on whether these substances are hazardous for humans. Chemicals for which the NTP issued a monograph and had concluded that there was clear or some evidence of adverse effects in humans were included by MECDC.

Globally Harmonized System of Classification and Labeling of Chemicals (GHS) The Globally Harmonized System of Classification and Labeling of Chemicals (GHS), published by the United Nations (UN) GHS sub-committee, addresses the classification of chemicals by hazard types and harmonized communication tools. The UN encourages countries to implement GHS worldwide. Japan launched the GHS Inter-ministerial Committee in 2001, and has published the GHS Classification Manual and the Technical Guidance used for GHS classification. The Committee has classified approximately 1,500 chemicals by GHS. Designation in Category 1A (human evidence is the main criterion for classification as a hazard) for reproductive toxicity was the inclusion criterion.

European Commission (EC) Endocrine Disruptor Program The mission of the EC is to promote the general interest of the European Union. The EC conducts work on a wide range of environmental issues and has established several databases that address chemical-specific issues undertaken by the EC to address chemical safety. On December 20, 1999, the EC adopted a Communication on a Community Strategy for Endocrine Disrupters: a range of substances suspected of interfering with the hormone systems of humans and wild life. The strategy focuses on man-made substances, including chemicals and synthetic hormones, which may harm health and cause cancer, behavioral changes and reproductive abnormalities. Designation of Category 1 for Humans (Appendix L) (evidence of endocrine disruptor activity) was the inclusion criterion.

International Agency for Research of Cancer (IARC) IARC is part of the World Health Organization. IARC's mission is to coordinate and conduct research on the causes of human cancer, the mechanisms of carcinogenesis, and to develop scientific strategies for cancer control. The Agency is involved in both epidemiological and laboratory research and disseminates scientific information through publications, meetings, courses, and fellowships. Designation of a chemical as belonging to Category 1 (known human carcinogen) was the inclusion criterion.

National Toxicology Program Report on Carcinogens The NTP is an interagency program managed by the US Department of Health and Human Services (DHHS) whose mission is to evaluate agents of public health concern by developing and applying tools of modern toxicology and molecular biology. The NTP publishes a list of carcinogens in its Report on Carcinogens (RoC). The RoC is an informational scientific and public health document first ordered by Congress in 1978 that identifies and discusses agents, substances, mixtures, or exposure circumstances that may pose a hazard to human health by virtue of their carcinogenicity. The category of known carcinogens was included.

U.S. Environmental Protection Agency Integrated Risk Information System The US Environmental Protection Agency (EPA) is the primary federal agency charged with protecting human health and the environment. As EPA states on its website "*IRIS* (Integrated Risk Information System) is a compilation of electronic reports on specific substances found in the environment and their potential to cause human health effects". Designation as a chemical in category A (known) carcinogens under the 1986 Guideline, or known carcinogens under the 1996, 1999, and 2005 Guidelines were considered in the toxicity criteria.

European Union Carcinogen List EU Directive on Dangerous Substances (Directive 67/548/EEC) introduced EU-wide provisions on the classification, packaging and labeling of dangerous substances. The classification of dangerous substances places a substance into one of several defined classes of danger and characterizes the type and severity of the adverse effects that the substance can cause. The Directive categorizes chemicals as carcinogens and reproductive toxicants. Designation as Category 1 (known or presumed to be a human carcinogen or reproductive toxicant) was the inclusion criterion.

Washington State Persistent Bioaccumulative and Toxic Chemical List In 2006, the Department of Ecology as directed by the Governor adopted regulations specific to PBTs (WAC 173-333). The PBT (persistent, bioaccumulative, and toxic) Initiative is a key part of Ecology's efforts to reduce toxic threats. It names the 'worst of the worst' toxic substances and suggests ways to reduce or remove the threat posed by them. Twenty-seven PBTs are identified including 25 organic chemicals/chemical groups and two 'metals of concern.' The legislation also requires Ecology and Department of Health (DOH) to issue one Chemical Action Plan (CAP) each year until all of the PBTs are assessed. Ecology and DOH are also required to prioritize the PBTs and to address first those that pose the greatest threat to human health and the environment. As part of this process, Ecology and DOH issued a multiyear CAP Schedule in 2007. The Washington list of PBTs was included in the criteria for toxicity. The chemicals identified as potential CHC from this list were confirmed to be on national or international lists, or identified by the State of Maine on the basis of extensive peer review literature searches.

Canadian PBiT List The *Canadian Environmental Protection Act, 1999* (CEPA 1999) is Canada's federal environmental legislation aimed at preventing pollution and protecting the environment and human health. As part of this effort, the Canadian government evaluated all compounds imported or produced in Canada and prioritized them for various criteria. The

results of these efforts are available on the web. Designation as PBiT (persistent, bioaccumulative and inherently toxic) was included as a criterion. In addition, one chemical on the Washington list of CHC was included on the basis of being banned in products for use by children under 3 years under the Canadian Hazardous Products Act.

B. Exposure Databases

Biomonitoring Studies

MECDC searched Pubmed (http://www.ncbi.nlm.nih.gov/pubmed/) for studies documenting the presence in humans in the general population for chemicals on the Washington list of 184 chemicals. Pubmed search terms included [chemical name] AND exposure, breast milk, blood, and/or urine. Occupational studies or studies from populations with an identified point source of exposure were not included. There was no attempt to do a comprehensive literature survey: one relevant paper was considered to be evidence of exposure. Nonetheless, a number of chemicals were identified in more than one study because the study contained other chemicals in the search. Therefore, a greater number of citations are not evidence of more exposure. The MECDC also updated the NHANES results to include the chemicals added in the 2009 National Biomonitoring Study.

Indoor Air and Dust Studies

MECDC searched Pubmed for studies documenting the presence in indoor air or dust for chemicals on the Washington list of 184 chemicals. Search terms included [chemical name] AND exposure, dust, and/or air. Occupational studies or studies from populations with an identified point source of exposure were not included. There was no attempt to do a comprehensive literature survey: one relevant paper was considered to be evidence of exposure. Nonetheless, a number of chemicals were identified in more than one study because the study contained other chemicals in the search. Therefore, a greater number of citations are not evidence of more exposure.

Product database

Danish EPA Reports

The Danish Environmental Protection Agency (DEPA) conducts a consumer products program. This includes a series of reports on chemicals present in consumer products as tested by the Danish EPA. This database was used to identify chemicals in children's and other household products.

Dutch Reports

The Netherlands Food and Consumer Product Safety Authority (NL) monitors food and consumer products to safeguard public health. This Authority controls entire production chains, from raw materials and processing aids, to end products and consumption.

EU Risk Assessment

The ESIS (European chemical Substances Information System) of the European Commission Joint Research Centre Institute for Health and Human Protection Final RUR was used to identify use in children's products.

National Library of Medicine Hazardous Substances Database

The Toxicology and Environmental Health Information Program (TEHIP) of the National Library of Medicine maintains a comprehensive web site with access to resources produced by TEHIP and by other government agencies and organizations. Its flagship resource is TOXNET, an integrated database system of hazardous chemicals, toxic releases and environmental health. The State of Washington used this site to identify chemicals that may be used in children's products.

EPA Inventory Use and Reporting (IUR) Database

The IUR database includes chemicals that are manufactured or imported in quantities of 25,000 pounds or more at a single site. The 2006 IUR includes information about chemicals manufactured or imported during calendar year 2005. In addition to the basic manufacturing information collected in previous reporting cycles, the 2006 cycle is the first time EPA collected information to characterize exposure during manufacturing, processing and use of organic chemicals. This includes information on whether a chemical is present in products intended for use by children 14 and under. The State of Washington used this database in its assessment of the potential for exposure to children.

National Library of Medicine Household Products

The US Department of Health and Human Services National Library of Medicine maintains a database that links over 10,000 consumer brands to health effects. Information in the Household Products Database is from a variety of publicly available sources including brand-specific labels and Material Safety Data Sheets when available from manufacturers and manufacturers' web sites. The database can be searched by chemical, which contains a list of products that contain the chemical. The State of Washington used this list to identify chemicals that were present in children's products.

EPA ChAMP Program

The ChAMP program is no longer updated, and was superseded by other initiatives in 2009. Under ChAMP, EPA evaluated and assigned priority for follow-up action on high production volume (HPV) and medium production volume (MPV) chemicals. EPA produced a number of monograghs for a limited number of chemicals that included information on chemical properties, toxicity, and in some instances product information. The State of Washington used this database to identify chemicals with potential exposure for children.

Routes of exposure

The State of Washington also categorized chemicals with respect to the probability of exposure to children via specific routes. This information is provided for completeness. No chemical was included in the list of CHC based on this information.

Inhalation - Using information on the properties of an individual chemical, the State of Washington determined whether the chemical was likely to be released into air from products.

Ingestion or mouthed or sucked by children - The possibility of ingestion or mouthing by children was made by the State of Washington on the basis of the type of product containing the chemical.

Dermal exposure - The potential for dermal exposure was made by the State of Washington on the basis of the type of product containing the chemical and the properties of the chemical.

Candidate Chemicals for CHC List		Toxicity																Exposure																				
CAS	Chemical	NTP_REP	GSH cat 1A repro	reprotex A+,A	Prop65_DEV	Prop65_MAL	Prop65_FEM	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	low tox value	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAPM child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer reviewed journals	VCCEP	Released into air	Ingested by child	Applied to skin
50-00-0	Formaldehyde													✓					5	14		✓		✓	✓	74		✓	✓			✓		✓
55-18-5	N-nitrosodiethylamine																		1										✓				✓	
56-23-5	Carbon tetrachloride																	3	2							3		✓						
62-53-3	Aniline			✓														1	2	4		✓				1		✓	✓			✓		
62-75-9	N-Nitrosodimethylamine																			1	2								✓				✓	
67-56-1	Methanol																✓		1					✓	✓	128		✓						
67-66-3	Chloroform																	5	9	1						3								
71-43-2	Benzene				✓	✓			✓	✓	✓		✓	✓				8	9	6		✓	✓		✓	11		✓			✓	✓		
74-87-3	Methyl chloride				✓												✓		1							1								
75-00-3	Chloroethane; Ethyl chloride																✓																	
75-01-4	Vinyl chloride								✓	✓	✓	✓	✓	✓					nd	1			NF		✓			✓	✓					
75-07-0	Acetaldehyde																		3	8						9		✓	✓			✓		
75-09-2	Methylene chloride			✓														nd	4	7					✓	48		✓	✓					
75-15-0	Carbon disulfide				✓	✓	✓										✓		nd,1	2	1				✓								✓	
75-25-2	Bromoform																	2											✓					
75-27-4	Bromodichloromethane																	2	1															
75-34-3	1,1-Dichloroethane																	nd											✓					
78-87-5	1,2-Dichloropropane																✓	nd	nd,1										✓					
79-00-5	1,1,2-Trichloroethane																	nd,2	3						✓				✓					
79-01-6	Trichloroethylene																✓	nd,3	6	1		✓		✓	✓	12		✓	✓		✓			
79-06-1	Acrylamide																✓	3							✓	2		✓					
79-34-5	1,1,2,2-Tetrachloroethane																	nd		2														
79-43-6	Dichloroacetic acid																												✓					
79-94-7	Tetrabromobisphenol A														✓			2	1	1		✓	✓		✓									
84-61-7	Dicyclohexyl phthalate; DCHP							✓										nd,1	4						✓									
84-66-2	Diethyl phthalate							✓									✓	8	10	15	1				✓	41		✓		1		✓		✓
84-74-2	Dibutyl phthalate; DBP	✓			✓	✓	✓	✓									✓	8	9	21	1	✓	✓			32		✓		1				
84-75-3	Di-n-Hexyl Phthalate	✓				✓	✓												1					✓	✓					1			✓	
85-68-7	Benzyl butyl phthalate; BBP				✓			✓										8	9	7	1		✓		✓	42		✓						
86-30-6	N-Nitrosodiphenylamine																			1									✓				✓	
87-68-3	Hexachlorobutadiene														✓	✓			nd	1														
91-22-5	Quinoline										✓																							
91-59-8	2-Naphthylamine								✓				✓	✓					1	1														

Candidate Chemicals for CHC List		Toxicity																Exposure																	
CAS	Chemical	NTP_REP	GSH cat 1A repro	reprotex A+,A	Prop65_DEV	Prop65_MAL	Prop65_FEM	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	low tox value	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAPM child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer reviewed journals	VCCEP	Released into air	Ingested by child	Applied to skin
91-94-1	3,3'-Dichlorobenzidine																			1														
92-69-3	4-Hydroxybiphenyl							✓										3																
92-87-5	Benzidine and its salts									✓				✓						1														
92-88-6	4,4'-Dihydroxybiphenyl							✓																										
94-13-3	Propyl paraben							✓										3		6	1			✓		>400		✓					✓	✓
94-26-8	Butyl paraben							✓										2	1	6	1					65		✓		1				✓
95-53-4	2-Aminotoluene													✓						3													✓	
95-69-2	4-Chloro-ortho-toluidine																			1														
95-80-7	2,4-Diaminotoluene																✓			1	1												✓	
96-09-3	Styrene oxide																			1														
96-12-8	1,2-Dibromo-3-chloropropane		✓		✓	✓		✓									✓	nd																
96-18-4	1,2,3-Trichloropropane																✓																	
99-76-3	Methyl paraben							✓										3	1	10	2			✓		>400		✓		1				✓
99-96-7	p-Hydroxybenzoic acid							✓												1	1													
100-41-4	Ethylbenzene																✓	5	8	14					✓	375		✓	✓		✓	✓		
100-42-5	Styrene							✓									✓	5	9	11	1	✓			✓	14		✓	✓			✓		
100-52-7	Benzaldehyde																✓		1	13						4		✓				✓	✓	✓
101-14-4	4,4´-Methylenebis(2-Chloroaniline)													✓						1									✓					
103-33-3	Azobenzene																																	
106-47-8	para-Chloroaniline																✓	2		3														
106-89-8	Epichlorohydrin					✓		✓												1								✓						
106-93-4	1,2-Dibromoethane					✓		✓			✓								nd						✓						✓			
106-99-0	1,3-Butadiene				✓	✓	✓		✓				✓	✓			✓	1	4	1					✓	4		✓						
107-06-2	1,2-Dichloroethane																	nd	nd,2	1					✓						✓			
107-13-1	Acrylonitrile																✓	2	1	1					✓			✓	✓				✓	
108-88-3	Toluene		✓	✓	✓												✓	8	10	19		✓	✓		✓	>400	✓	✓			✓	✓		✓
109-86-4	2-Methoxyethanol				✓	✓											✓		nd	2								✓						
110-49-6	Methyl cellosolve acetate				✓	✓														1														
110-80-5	Ethylene glycol monoethyl ether				✓	✓											✓		1	4								✓				✓		
110-86-1	Pyridine																✓			1														
111-15-9	2-ethoxyethyl acetate				✓	✓														1														
115-96-8	Tris(2-chloroethyl) phosphate															✓			2	2	1	✓	✓		✓				✓	1		✓	✓	
117-81-7	Di-(2-ethylhexyl) phthalate; DEHP				✓	✓		✓										9	10	22	1	✓	✓	✓	✓	1		✓		1				

Candidate Chemicals for CHC List		Toxicity																Exposure																	
CAS	Chemical	NTP_REP	GSH cat 1A repro	reprotex A+,A	Prop65_DEV	Prop65_MAL	Prop65_FEM	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	low tox value	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAPM child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer reviewed journals	VCCEP	Released into air	Ingested by child	Applied to skin
117-84-0	Di-n-octyl phthalate; DOP																	3	2	5	1			✓				✓		1				
118-74-1	hexachlorobenzene		✓		✓			✓							✓			6																
119-90-4	3,3´-Dimethoxybenzidine																																	
119-93-7	Metabolized to 3,3´-																✓			3														
120-47-8	Ethyl paraben							✓										2	1	6	1					75		✓		1				✓
123-91-1	1,4-Dioxane																			2			✓	✓	✓	2		✓	✓		✓			✓
127-18-4	Perchloroethylene																✓	5	6	3		✓			✓	30		✓	✓		✓			
131-55-5	2,2',4,4'-tetrahydroxybenzophenone							✓												1						73								✓
131-56-6	2,4-Dihydroxybenzophenon							✓										1						✓		25				1				
131-70-4	Mono-n-butylphthalate							✓										4		2														
140-66-9	1,1,3,3-Tetramethyl-4-butylphenol							✓										5		1	1			uk					✓				✓	
140-67-0	Estragole																			3				✓			✓	✓						
149-57-5	2-Ethylhexanoic acid				✓															4	1	✓		✓	✓	4		✓					✓	
556-67-2	Octamethylcyclotetrasiloxane							✓								✓			1	4				✓	✓	26		✓	✓	1		✓		✓
608-93-5	Benzene, pentachloro-							✓							✓	✓	✓	2																
842-07-9	C.I. Solvent Yellow 14																				1							✓						
872-50-4	N-Methylpyrrolidone				✓															10					✓	42		✓	✓				✓	
924-16-3	N-Nitroso-di-n-butylamine																			1	2													
930-55-2	N-Nitrosopyrrolidine																																✓	
1163-19-5	2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether; BDE-209														✓			1	2	2			✓		✓						✓			
1327-53-3	Diarsenic trioxide												✓																					
1461-25-2	Tetrabutyltin																			1		✓												
1634-04-4	Methyl tert-butyl ether; MTBE							✓									✓	4	4						✓									
1763-23-1	perfluorooctanyl sulphonic acid and its salts; PFOS														✓			5	3	1										2				
1806-26-4	Phenol, 4-octyl-							✓										nd,2	1		1									1			✓	
2425-85-6	2-Naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]-															✓				1						4		✓						
4376-20-9	Mono 2 ethyl hexylphthalate; MEHP							✓										3																
5466-77-3	2-ethyl-hexyl-4-methoxycinnamate							✓												1				✓		109								✓
7439-97-6	Mercury & mercury compounds		✓		✓										✓			3	1	3				✓		2		✓	✓					
7440-02-0	Nickel & nickel compounds				✓				✓								✓	3	2	9		✓			✓	3			✓	1				
7440-38-2	Arsenic & Arsenic compounds		✓						✓	✓		✓		✓				6	5	4						5		✓	✓					
7440-41-7	Beryllium & Beryllium compounds								✓		✓	✓		✓				4																

Candidate Chemicals for CHC List		Toxicity															Exposure																				
CAS	Chemical	NTP_REP	GSH cat 1A repro	reprotex A+,A	Prop65_DEV	Prop65_MAL	Prop65_FEM	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	low tox value	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAPM child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer reviewed journals	VCCEP	Released into air	Ingested by child	Applied to skin
7440-43-9	Cadmium				✓	✓			✓					✓				8	2	5	1	✓				6		✓	✓						
7440-48-4	Cobalt & Cobalt compounds																	3	1	5		✓				1		✓	✓						
14808-60-7	Quartz								✓			✓		✓											✓	>400		✓	✓						✓
15541-45-4	Bromate										✓																								
25013-16-5	Butylated hydroxyanisole							✓																✓		41		✓						✓
25637-99-4	Hexabromocyclododecane														✓			1	2				✓	✓									✓	
26471-62-5	Toluene diisocyanate; TDI																✓			1								✓						
26761-40-0	Diisodecyl Phthalate; DIDP				✓													1		3		✓	✓		✓			✓						
27193-28-8	(1,1,3,3-tetramethylbutyl)-Phenol							✓												1														

Legend

✓ Found to be present

nd chemical not detected

Toxicology Data Sources

NTP_REP	National Toxicology Program Evaluation of Risks to Human Reproduction - Clear o Some Evidence of adverse reproductive or developmental effects
GSH cat 1A repro	Global Harmonization System - Category 1A for reproductive or germ cell mutagenicity, known
reprotext A+, A	REPROTEXT® database for reproductive and developmental toxicants - A+,A
Prop 65 dev	California Proposition 65 Program - Impact to development
Prop65_FEM	California's Proposition 65 Program - Impact to female
Prop65_MAL	California's Proposition 65 Program - Impact to males
EU_END1	European Union Endocrine Disruptor Program - Category 1, probable
NTP_cancer	National Toxicology Prrogram. Report on Carcinogens - Known human carcinogen
IRIS_86A	EPA Integrated Risk Information System-1986 critera, Known human carcinogen
IRIS 96	EPA Integrated Risk Information System-1996 Known human carcinogen
GSH category 1A cancer	Global Harmonization System Catergory 1A, Known human carcinogen
EU carcinogen 1A	European Union Carcinogen List, Category 1, Known carcinogen
IARC_1	IARC - Group 1 - Known human carcinogen
WA_PBT	Washington State PBT Program with supporting ME-CDC review of peer-reviewd publications
CAN PBiT or HAS	Canadian Environmental Protection Act PB & inherently Toxic chemicals or Hazardous Substances Act
Low tox value	Low toxicity values for selected endpoints based on ATSDR and RTEC

Exposure Studies

Biomonitoring	Identified as present in human tissue by US CDC or pubmed search, numbers refer to number of studies in which chemical was identified.
Indoor air and dust	Identified as present in indoor air or dust by Pubmed search, numbers refer to number of studies in which chemical was identified.

Consumer Product Data

Danish EPA	Identifed as present in consumer products by the Danish EPA
Dutch reports	Identified as present in consumer products by the Dutch government
German Federal Environment Agency	
ESIS Risk Assessment Report	EU or other authoritative risk assesment indicating use in consumer products
HSDB_NLM	Listed in National Library of Medicine Hazardous Substances Databas
EPA_Inventory Use Report	EPA Inventory Use and Reporting database indicating use in consumer products
HPD_NLM household products	Household Products Database, National Library of Medicine used in consumer products
SPIN	Substances in Products in Nordic Countries Database
TSCA Work Plan Chemicals	
Peer Reviewed Journals	
VCCEP	
ChAMP child exp	EPA ChAMP program indicating potential exposure to children
Released into air	Potential release into air based on properties of chemical
Ingested by child	Potential ingestion, mouthing, or sucking by child based on product type
Applied to skin	Product is applied to skin

List of Chemicals of High Concern		Toxicity											Exposure																		
CAS	Chemical	NTP_REP	GSH cat 1A repro	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAMP child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer Reviewed Journals	VCCEP	Released into air	Ingested by child	Applied to skin
50-00-0	Formaldehyde									✓				5	14		✓		✓	✓	74		✓	✓					✓
71-43-2	Benzene				✓	✓	✓		✓	✓			8	9	6		✓	✓		✓	11		✓			✓	✓		
75-01-4	Vinyl chloride				✓	✓	✓	✓	✓	✓				nd	1			NF		✓			✓	✓					
79-94-7	Tetrabromobisphenol A										✓		2	1	1		✓	✓		✓									
84-61-7	Dicyclohexyl phthalate; DCHP			✓									nd,1	4						✓									
84-66-2	Diethyl phthalate			✓									8	10	15	1				✓	41		✓		1		✓		✓
84-74-2	Dibutyl phthalate, DBP	✓		✓									8	9	21	1	✓	✓			32		✓		1				
84-75-3	Di-n-Hexyl Phthalate	✓												1					✓	✓					1			✓	
85-68-7	Benzyl Butyl phthalate; BBP			✓									8	9	7	1		✓		✓	42		✓						
87-68-3	Hexachlorobutadiene										✓	✓		nd	1														
91-59-8	2-Naphthylamine				✓				✓	✓				1	1														
92-69-3	4-Hydroxybiphenyl			✓									3																
92-87-5	Benzidine and its salts					✓				✓					1														
94-13-3	Propyl paraben			✓									3		6	1			✓		>400		✓					✓	✓
94-26-8	Butyl paraben			✓									2	1	6	1					65		✓		1				✓
95-53-4	2-Aminotoluene									✓					3													✓	
99-76-3	Methyl paraben			✓									3	1	10	2			✓		>400		✓		1				✓
99-96-7	p-Hydroxybenzoic acid			✓											1	1												✓	
100-42-5	Styrene			✓									5	9	11	1	✓			✓	14		✓	✓			✓		
101-14-4	4,4´-Methylenebis(2-Chloroaniline)									✓					1									✓					
106-89-8	Epichlorohydrin			✓											1								✓						
106-93-4	1,2-Dibromoethane			✓			✓							nd						✓						✓			
106-99-0	1,3-Butadiene				✓				✓	✓			1	4	1					✓	4		✓						

List of Chemicals of High Concern		Toxicity											Exposure																	
CAS	Chemical	NTP_REP	GSH cat 1A repro	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAMP child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer Reviewed Journals	VCCEP	Released into air	Ingested by child	Applied to skin
108-88-3	Toluene		✓										8	10	19		✓	✓		✓	>400		✓			✓	✓		✓
115-96-8	Tris(2-chloroethyl) phosphate											✓		2	2	1	✓	✓		✓				✓	1		✓	✓	
117-81-7	Di-(2-ethylhexyl) phthalate, DEHP			✓									9	10	22	1	✓	✓	✓	✓	1		✓		1				
118-74-1	Hexachlorobenzene		✓	✓							✓		6																
120-47-8	Ethyl paraben			✓									2	1	6	1					75		✓		1				✓
131-55-5	2,2',4,4'-tetrahydroxybenzophenone, BP-2			✓											1						73								✓
131-56-6	2,4-Dihydroxybenzophenon			✓									1						✓		25				1				
131-70-4	Mono-n-butylphthalate			✓									4		2														
140-66-9	1,1,3,3-Tetramethyl-4-butylphenol			✓									5		1	1			uk					✓				✓	
556-67-2	Octamethylcyclotetrasiloxane			✓								✓		1	4				✓	✓	26		✓	✓	1		✓		✓
608-93-5	Benzene, pentachloro-			✓							✓	✓	2																
1163-19-5	2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether; BDE-209										✓		1	2	2			✓		✓						✓			
1634-04-4	Methyl tert-butyl ether; MTBE			✓									4	4						✓									
1763-23-1	perfluorooctanyl sulphonic acid and its salts; PFOS										✓		5	3	1										2				
1806-26-4	Phenol, 4-octyl-			✓									nd,2	1		1									1			✓	
2425-85-6	2-Naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]-											✓			1						4		✓						
5466-77-3	2-ethyl-hexyl-4-methoxycinnamate			✓											1				✓		109								✓
7439-97-6	Mercury & mercury compounds		✓								✓		3	1	3				✓		2	✓	✓	✓					
7440-02-0	Nickel & nickel compounds				✓								3	2	9		✓			✓	3			✓	1				
7440-38-2	Arsenic & Arsenic compounds		✓		✓	✓		✓		✓			6	5	4						5		✓	✓					
7440-41-7	Beryllium & Beryllium compounds				✓		✓	✓		✓			4																
7440-43-9	Cadmium				✓					✓			8	2	5	1	✓				6		✓	✓					
14808-60-7	Quartz				✓			✓		✓										✓	>400		✓	✓					✓
25013-16-5	Butylated hydroxyanisole			✓															✓		41		✓						✓

List of Chemicals of High Concern		Toxicity											Exposure																	
CAS	Chemical	NTP_REP	GSH cat 1A repro	EU_END1	NTP_cancer	IRIS_86A	IRIS_96	GSH cat 1 cancer	EU carcinogen 1A	IARC_1	WA_PBT	CAN_PBiT or HAS	Biomonitoring	Indoor air and dust	Danish EPA	Dutch (NL) Reports	German FEA	ESIS_RAR	HSDB_NLM	EPA Inventory Use (IUR)	HPD_NLM	ChAMP child exp	SPIN	2012 TSCA Work Plan Consumer Products	Peer Reviewed Journals	VCCEP	Released into air	Ingested by child	Applied to skin
25637-99-4	Hexabromocyclododecane										✔		1	2				✔	✔										✔	
27193-28-8	(1,1,3,3-tetramethylbutyl)-phenol			✔											1														

Note: Please see text for further description of data sources and evaluation process.

Legend

✔	Found to be present
C	information is confidential in SPIN

Toxicology Data Sources

NTP_REP	National Toxicology Program Evaluation of Risks to Human Reproduction - Clear or some evidence for of adverse reproductive or developmental effects
GSH cat 1A repro	Global Harmonization System - Category 1A for reproductive or germ cell mutagenicity, known
EU_END1	EU Endocrine Disruptor Program - Category 1, probable
NTP_cancer	Nat. Tox. Prg. Report on Carcinogens - Known human carcinogen
IRIS_86A	EPA Integrated Risk Information System -1986 critera - Known human carcinogen
IRS 96	EPA Integrated Risk Information System -1996 Known carcinogenic to humans
GSH category 1A cancer	Global Harmonization System Catergory 1A - Known human carcinogen
EU carcinogen 1A	European Union Carcinogen List, Category 1, Known carcinogen
IARC_1	IARC - Group 1 - Known human carcinogen
WA_PBT	Washington State PBT Program with supporting ME-CDC review of peer-reviewd publications
CAN PBiT or HAS	Canadian Environmental Protection Act PB & inherently Toxic chemicals or Hazardous Substances Act - Present on list

Exposure Studies

Biomonitoring	Identified as present in human tissue by biomonitoring studies identified by a Pubmed search, numbers refer to number of studies in which chemical was identified.
Indoor air and dust	Identified as present in indoor air or dust by Pubmed search, numbers refer to number of studies in which chemical was identified.

Consumer Product Data

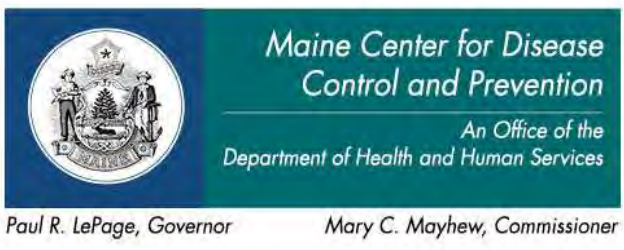
Danish EPA	Identifed as present in consumer products by the Danish EPA
Dutch reports	Identified as present in consumer products by the Dutch government
German Federal Environment Agency	
ESIS Risk Assessment Report	EU or other authoritative risk assesment indicating use in consumer products
HSDB_NLM	Listed in National Library of Medicine Hazardous Substances Database
EPA_Inventory Use Report	EPA Inventory Use and Reporting database indicating use in consumer products
HPD_NLM household products	Household Products Database, National Library of Medicine used in consumer products
SPIN	Substances in Products in Nordic Countries Database
TSCA Work Plan Chemicals	
Peer Reviewed Journals	
VCCEP	
ChAMP child exp	EPA ChAMP program indicating potential exposure to children
Released into air	Potential release into air based on properties of chemical
Ingested by child	Potential ingestion, mouthing, or sucking by child based on product type
Applied to skin	Product is applied to skin

Deriving Chemicals of High Concern
Process Documentation

Appendix III
Chemical Specific Inclusion Criteria
July 1, 2012

This document presents the rationale for inclusion and support for each chemical on the CHC list, as presented in the Maine CDC Chemicals of High Concern Process Documentation.

Environmental & Occupational Health Programs
Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor, Augusta, ME 04333
207.287.4311 • 866.292.3474



Contents Page

Formaldehyde (CAS 50-00-0)

Criteria for inclusion of formaldehyde in the CHC List: IARC - Group 1 known human carcinogen.

The presence of formaldehyde in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of formaldehyde was identified in 5 indoor air and/or dust studies (preliminary literature search).

1. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
2. Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: concentrations and impact factors." Indoor Air 19: 206-217.
3. Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air 10: 178-192.
4. Koziel, J.,Noah, J.,Pawliszyn, J. (2001). "Field sampling and determination of formaldehyde in indoor air with solid-phase microextraction and on-fiber derivatization." Environmental Science & Technology 35: 1481-1486.
5. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.

Benzene (CAS 71-43-2)

Criteria for inclusion of benzene in the CHC List: NTP Report on Carcinogens - known carcinogen, EPA Integrated Risk Information System - 1986 criteria, known carcinogen, EPA Integrated Risk Information System – 1996 known carconogen, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen.

The presence of benzene in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives 114(8): 1210-1214.
3. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
4. Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epideniology 18: 421-429.
5. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.

6. Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives 113(3): 342-348.
7. Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives 114(3): 453-459.
8. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of benzene was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Adgate, J. L.,Church, T. R.,Ryan, A. D.,Ramachandran, G.,Fredrickson, A. L.,Stock, T. H.,Morandi, M. T.,Sexton, K. (2004). "Outdoor, indoor and personal exposure to VOCs in children." Environmental Health Perspectives 112(14): 1386-1392.
2. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
3. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
4. Liu, J.,Drane, W.,Liu, X.,Wu, T. (2009). "Examination of the relationships between environmental exposures to volatile organic compounds and biochemical liver tests: application of canonical correlation analysis." Environmental Research 109(2): 193-199.
5. Miller, S. L.,Branoff, S.,Nazaroff, W. W. (1998). "Exposure to toxic air contaminants in environmental tobacco smoke: An assessment for California based on personal monitoring data." Journal of Exposure Analysis and Environmental Epidemiology 8(3): 287-311.
6. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
7. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
8. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
9. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Vinyl chloride (CAS 75-01-4)

Criteria for inclusion of vinyl chloride in the CHC List: NTP Report on Carcinogens - known carcinogen, EPA Integrated Risk Information System - 1986 criteria, known carcinogen, EPA Integrated Risk Information System - 1996, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen, Global Harmonization System - Category 1A known human carcinogen.

The presence of vinyl chloride in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of vinyl chloride was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Tetrabromobisphenol A (CAS 79-94-7)

Criteria for inclusion of tetrabromobisphenol A in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. A review by the Maine CDC identified about two dozen studies documenting effects on reproductive, developmental, endocrine, or cancer endpoints. Studies were also identified with data on levels of TBBPA in humans.

1. Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Brominated Flame Retardants as a Priority Chemical, November 22, 2010

The presence of tetrabromobisphenol A in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
2. Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology 36(7): 1414-1418.

The presence of tetrabromobisphenol A was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

Dicyclohexyl phthalate; DCHP (CAS 84-61-7)

Criteria for inclusion of dicyclohexyl phthalate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of dicyclohexyl phthalate in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

The presence of dicyclohexyl phthalate was identified in 4 indoor air and/or dust studies (preliminary literature search).

1. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
2. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
3. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.

4. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Diethyl phthalate (CAS 84-66-2)

Criteria for inclusion of diethyl phthalate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of diethyl phthalate in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
4. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
5. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
6. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
7. Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives 118(6): 825-832.
8. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of diethyl phthalate was identified in 10 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.

3. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.
4. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
5. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
6. Just, A. C.,Adibi, J. J.,Rundle, A. G.,Calafat, A. M.,Camann, D.,Hauser, R.,Silva, M. J.,Whyyatt, R. M. (2010). "Urinary and air phthalate concentrations and self-reported use of personal care products among minority pregnant women in New York city." Journal of Exposure Science and Environmental Epideniology 20: 625-633.
7. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
8. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
9. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
10. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Dibutyl phthalates; DBP (CAS 84-74-2)

Criteria for inclusion of DBP (dibutyl phthalates) in the CHC List: NTP – clear evidence of adverse reproductive and developmental effects, EU Endocrine Disruptor Program - Category 1 probable.

The presence of DBP (dibutyl phthalates); di-n-butyl phthalate in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
4. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
5. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
6. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

7. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121
8. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of DBP (dibutyl phthalates); di-n-butyl phthalate was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
3. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.
4. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
5. Just, A. C.,Adibi, J. J.,Rundle, A. G.,Calafat, A. M.,Camann, D.,Hauser, R.,Silva, M. J.,Whyyatt, R. M. (2010). "Urinary and air phthalate concentrations and self-reported use of personal care products among minority pregnant women in New York city." Journal of Exposure Science and Environmental Epideniology 20: 625-633.
6. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
7. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
8. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
9. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Di-n-Hexyl phthalate (CAS 84-75-3)

Criteria for inclusion of di-n-hexyl phthalate in the CHC List: NTP – clear evidence of adverse reproductive effects.

The presence of di-n-hexyl phthalate in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of di-n-hexyl phthalate was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Benzyl butyl phthalate; Butyl benzyl phthalate; BBzP (CAS 85-68-7)

Criteria for inclusion of Benzyl butyl phthalate; BBP in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of benzyl butyl phthalate; BBP in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
4. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
5. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
6. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
7. Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives 118(6): 825-832.
8. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of butyl benzyl phthalate; BBP was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
3. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.

4. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
5. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
6. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
7. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
8. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
9. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Hexachlorobutadiene (CAS 87-68-3)

Criteria for inclusion of hexachlorobutadiene in the CHC List: Canadian Environmental Protection Act - PersistentBioaccumulative & Inherently Toxic,

The presence of hexachlorobutadiene in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of hexachlorobutadiene was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

2-Naphthylamine (CAS 91-59-8)

Criteria for inclusion of 2-naphthylamine in the CHC List: NTP Report on Carcinogens - known carcinogen, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen.

The presence of 2-naphthylamine in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-naphthylamine was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Wilson, W. E.,Lioy, P. J. (1994). "Sources of organic acids in indoor air: a field study." Journal of Exposure Analysis and Environmental Epidemiology 4(1): 25-47.

4-Hydroxybiphenyl; (CAS 92-69-3)

Criteria for inclusion of 4-hydroxybiphenyl in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 4-hydroxybiphenyl in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.
3. Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta 622:150-156.

The presence of 4-hydroxybiphenyl; 4-phenylphenol was not identified in indoor air and/or dust studies (preliminary literature search).

Benzidine and its salts (CAS 92-87-5)

Criteria for inclusion of benzidine and its salts in the CHC List: EPA Integrated Risk Information System - 1986 criteria, known carcinogen, IARC - Group 1 known human carcinogen.

The presence of benzidine and its salts in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of benzidine and its salts was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Propyl paraben (CAS 94-13-3)

Criteria for inclusion of propyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of propyl paraben in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.

2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.
3. Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta 622:150-156.

The presence of propyl paraben was not identified in indoor air and/or dust studies (preliminary literature search).

Butyl paraben (CAS 94-26-8)

Criteria for inclusion of butyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of butyl paraben in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.

The presence of butyl paraben was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

2-Aminotoluene (CAS 95-53-4)

Criteria for inclusion of 2-aminotoluene in the CHC List: IARC - Group 1 known human carcinogen.

The presence of 2-aminotoluene in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-aminotoluene was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Methyl paraben (CAS 99-76-3)

Criteria for inclusion of methyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of methyl paraben in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.
3. Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta 622:150-156.

The presence of methyl paraben was identified in 1 indoor air and/or dust study (preliminary literature search).

1. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

p-Hydroxybenzoic acid (CAS 99-96-7)

Criteria for inclusion of p-hydroxybenzoic acid in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of p-hydroxybenzoic acid in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of p-hydroxybenzoic acid was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Styrene (CAS 100-42-5)

Criteria for inclusion of styrene in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of styrene in humans was identified in 5 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.

2. Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives 114(8): 1210-1214.
3. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
4. Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives 113(3): 342-348.
5. Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives 114(3): 453-459.

The presence of styrene was identified in 9 indoor air and/or dust studies (preliminary literature search).

1. Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology 36(7): 1414-1418.
2. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
3. Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: concentrations and impact factors." Indoor Air 19: 206-217.
4. Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air 10: 178-192.
5. Miller, S. L.,Branoff, S.,Nazaroff, W. W. (1998). "Exposure to toxic air contaminants in environmental tobacco smoke: An assessment for California based on personal monitoring data." Journal of Exposure Analysis and Environmental Epidemiology 8(3): 287-311.
6. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
7. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
8. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
9. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

4,4´-Methylenebis(2-Chloroaniline) (CAS 101-14-4)

Criteria for inclusion of 4,4´-methylenebis(2-chloroaniline) in the CHC List: IARC - Group 1 known human carcinogen.

The presence of 4,4´-methylenebis(2-chloroaniline) in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 4,4´-methylenebis(2-chloroaniline) was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Epichlorohydrin (CAS 106-89-8)

Criteria for inclusion of epichlorohydrin in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of epichlorohydrin in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of epichlorohydrin was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

1,2-Dibromoethane (CAS 106-93-4)

Criteria for inclusion of 1,2-dibromoethane in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 1,2-dibromoethane in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 1,2-dibromoethane was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

1,3-Butadiene (CAS 106-99-0)

Criteria for inclusion of 1,3-butadiene in the CHC List: NTP Report on Carcinogens - known human carcinogen, IARC - Group 1 known human carcinogen, European Union carcinogen list, Category 1, known carcinogen.

The presence of 1,3-butadiene in humans was identified in 1 biomonitoring study (preliminary literature search).

1. Schettgen, T.,Musiol, A.,Alt , E.,Ochsmann, E. (2009). "A Method for the quantification of biomarkers of exposure to acrylonitrile and 1, 3-butadiene in human urine by column-switching liquid chromatography- tandem mass spectrometry." Analytical and Bioanalytical Chemistry 393: 969-981.

The presence of 1,3-butadiene was identified in 4 indoor air and/or dust studies (preliminary literature search).

1. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
2. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
3. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
4. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Toluene (CAS 108-88-3)

Criteria for inclusion of toluene in the CHC List: Global Harmonization System - category 1A for known reproductive or germ cell mutagenicity.

The presence of toluene in humans was identified in 8 biomonitoring studies (preliminary literature search.

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives 114(8): 1210-1214.
3. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
4. Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epideniology 18: 421-429.
5. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
6. Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives 113(3): 342-348.

7. Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives 114(3): 453-459.
8. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of toluene was identified in 10 indoor air and/or dust studies (preliminary literature search).

1. Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology 36(7): 1414-1418.
2. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
3. Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: concentrations and impact factors." Indoor Air 19: 206-217.
4. Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air 10: 178-192.
5. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
6. Liu, J.,Drane, W.,Liu, X.,Wu, T. (2009). "Examination of the relationships between environmental exposures to volatile organic compounds and biochemical liver tests: application of canonical correlation analysis." Environmental Research 109(2): 193-199.
7. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
8. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
9. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
10. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Tris (2-chloroethyl) phosphate (CAS 115-96-8)

Criteria for inclusion of tris (2-chloroethyl) phosphate in the CHC List: Canadian Environmental Protection Act – Persistent bioaccumulative & inherently toxic.

The presence of tris(2-chloroethyl) phosphate in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of tris(2-chloroethyl) phosphate was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. HÅkan Carlsson, Ulrika Nilsson, Gerhard Becker, and Conny Östman (1997) Organophosphate Ester Flame Retardants and Plasticizers in the Indoor Environment: Analytical Methodology and Occurrence. Environ. Sci. Technol., 1997, 31 (10), pp 2931-2936
2. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.

Di-(2-ethylhexyl) phthalate; DEHP (CAS 117-81-7)

Criteria for inclusion of DEHP (di-(2-ethylhexyl) phthalate) in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of DEHP (di-(2-ethylhexyl) phthalate); bis(2-ethylhexyl) phthalate in humans was identified in 9 biomonitoring studies (preliminary literature search).

1. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
2. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
3. Becker, K.,Seiwert, M.,Angerer, J.,Heger, W.,Koch, H. M.,Nagorka, R.,Robkamp, E.,Schluter, C.,Seifert, B.,Ullrich, D. (2004). "DEHP matabolites in urine of children and DEHP in house dust." International journal of Environmental Health 2007: 409-417.
4. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
5. Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography 24: 1094-1099.
6. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
7. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

8. Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives 118(6): 825-832.
9. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of DEHP (di-(2-ethylhexyl) phthalate); bis(2-ethylhexyl) phthalate was identified in 10 indoor air and/or dust studies (preliminary literature search).

1. Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to Phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives 111(14): 1719-1722.
2. Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives 116(4): 467-473.
3. Becker, K.,Seiwert, M.,Angerer, J.,Heger, W.,Koch, H. M.,Nagorka, R.,Robkamp, E.,Schluter, C.,Seifert, B.,Ullrich, D. (2004). "DEHP matabolites in urine of children and DEHP in house dust." International journal of Environmental Health 2007: 409-417.
4. Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives 113(10): 1399-1404.
5. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.
6. Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air 14: 188-195.
7. Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspective 116(1): 98-103.
8. Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology 35(15): 3099-31002.
9. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
10. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

Hexachlorobenzene (CAS 118-74-1)

Criteria for inclusion of hexachlorobenzene in the CHC List: EU Endocrine Disruptor Program - Category 1 probable, Global Harmonization System - Category 1A for known reproductive or germ cell mutagenicity.

The presence of hexachlorobenzene in humans was identified in 7 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.

2. Damgaard, I. N.,Skakkebaek, N. E.,Toppari, J.,Virtanen, H. E.,Shen, H.,Schramm, K. W.,Petersen, J. H.,Jensen, T. K.,Main, K. M.,Group, T. N. C. S. (2006). "Persistent pesticides in human breast milk and cryptorchidism." Environmental Health Perspectives 114(7): 1133-1138.
3. Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives 109(12): 1291-1299.
4. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
5. Ribas-Fitó, N.,Torrent, M.,Carrizo, D.,Júlvez, J.,Grimalt, J. O.,Sunyer, J. (2007). "Exposure to hexachlorobenzene during pregnancy andcChildren's social behavior at 4 years of age." Environmental Health Perspectives 115(3): 447-450.
6. Shen H, Main K, Andersson A, Damgaard I, Helena E. Virtanen H, Skakkebaek E, Toppari J, and Schramm K (2008). Concentrations of persistent organochlorine compounds in human milk and placenta are higher in Denmark than in Finland. Human Reproduction Vol.23, No.1 pp. 201–210
7. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of hexachlorobenzene was not identified in indoor air and/or dust studies (preliminary literature search).

Ethyl paraben (CAS 120-47-8)

Criteria for inclusion of ethyl paraben in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of ethyl paraben in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives 116(1): 39-44.
2. Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B 844: 53-59.

The presence of ethyl paraben was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Camann R, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553

Benzophenone-2; (Bp-2), 2,2',4,4'-tetrahydroxybenzophenone (CAS 131-55-5)

Criteria for inclusion of benzophenone-2 (BP-2), 2,2',4,4'-tetrahydroxybenzophenone in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of benzophenone-2 (BP-2), 2,2',4,4'-tetrahydroxybenzophenone in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of benzophenone-2 (BP-2), 2,2',4,4'-tetrahydroxybenzophenone was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

2,4-Dihydroxybenzophenon; Resbenzophenone (CAS 131-56-6)

Criteria for inclusion of 2,4-dihydroxybenzophenon; resbenzophenone in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 2,4-dihydroxybenzophenon; resbenzophenone in humans was identified in 1 biomonitoring study (preliminary literature search).

1. Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives 109(12): 1291-1299.

The presence of 2,4-dihydroxybenzophenon; resbenzophenone was not identified in indoor air and/or dust studies (preliminary literature search).

Mono-n-butylphthalate (CAS 131-70-4)

Criteria for inclusion of mono-n-butylphthalate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of mono-n-butylphthalate in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspective 114(2): 270-276.
2. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121
3. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of mono-n-butylphthalate was not identified in indoor air and/or dust studies (preliminary literature search).

4-tert-Octylphenol; 1,1,3,3-Tetramethyl-4-butylphenol (CAS 140-66-9)

Criteria for inclusion of 4-tert-octylphenol; 1,1,3,3-tetramethyl-4-butylphenol in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 4-tert-octylphenol; 1,1,3,3-tetramethyl-4-butylphenol in humans was identified in 5 biomonitoring studies (preliminary literature search).

1. Calafat, A. M.,Wong, L. Y.,Silva, M. J.,Samandar, E.,Preau, J. L. J.,Jia, L. T.,Needham, L. L. (2011). "Selecting adequate exposure biomarkers of diisononyl and diisodecyl phthalates: Data from the 2005-2006 National Health and Nutrition Examination Survey." Environmental Health Perspectives 119(1): 50-55.
2. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
3. Chen, G. W.,Ding, W. H.,Ku, H. Y.,Chao, H. R.,Chen, H. Y.,Huang, M. C.,Wang, S. L. (2010). "Alkylphenols in human milk and their relations to dietary habits in Central Taiwan " Food and Chemical Toxicology 48: 1939-1944.
4. Lopez-Espinosa, M. J.,Freire, C.,Arrebola, J. P.,Navea, N.,Taoufiki, J.,Fernandez, M. K.,Ballesteros, O.,Prada, R.,Olea, N. (2009). "Nonylphenol and octylphenol in adipose tissue of women in Southern Spain." Chemosphere 76: 847-852.
5. Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study Of urinary biomarkers Of phytoestrogens, phthalates, and phenols In girls." Environmental Health Perspectives 115 (1): 116-121

The presence of 4-tert-octylphenol; 1,1,3,3-tetramethyl-4-butylphenol was not identified in indoor air and/or dust studies (preliminary literature search).

Octamethylcyclotetrasiloxane (CAS 556-67-2)

Criteria for inclusion of octamethylcyclotetrasiloxane in the CHC List: EU Endocrine Disruptor Program - Category 1 probable, Canadian Environmental Protection Act – persistent bioaccumulative & inherently toxic.

The presence of octamethylcyclotetrasiloxane in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of octamethylcyclotetrasiloxane was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Lu, Y.,Yuan, T.,Yun, S. H.,Wang, W.,Gian Wu, G.,Kannan, K. (2010). "Occurrence of cyclic and lsnear Siloxanes in indoor dust from China, and implications for human exposures." Environmental Science Technology 44(16): 6081-6087.

Benzene, pentachloro- (CAS 608-93-5)

Criteria for inclusion of benzene, pentachloro- in the CHC List: EU Endocrine Disruptor Program - Category 1 probable, Canadian Environmental Protection Act - PersistentBioaccumulative & Inherently Toxic.

The presence of benzene, pentachloro- in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. Damgaard, I. N.,Skakkebaek, N. E.,Toppari, J.,Virtanen, H. E.,Shen, H.,Schramm, K. W.,Petersen, J. H.,Jensen, T. K.,Main, K. M.,Group, T. N. C. S. (2006). "Persistent pesticides in human breast milk and cryptorchidism." Environmental Health Perspectives 114(7): 1133-1138.
2. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

The presence of benzene, pentachloro- was not identified in indoor air and/or dust studies (preliminary literature search).

2,2',3,3',4,4',5,5',6,6'-Decabromodiphenyl ether; BDE-209 (CAS 1163-19-5)

Criteria for inclusion of 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether; BDE-209 in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. Reports to the Maine State Legislature by the MEDEP and MECDC reviewed numerous peer-reviewed studies documenting adverse endocrine and developmental effects of deca BDE, including effects on thyroid hormones and developmental neurotoxicity.[1]

The presence of 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether; BDE -209 in humans was identified in 1 biomonitoring studiy (preliminary literature search).

1. Gomara, B.,Herrero, L.,Ramos, J. J.,Mateo, J. R.,Fernández, M. A.,Garcıa, J. F.,González, M. J. (2007). "Distribution of polybrominated diphenyl ethers in human umbilical cord serum, Paternal serum, maternal serum, placentas, and breast milk from Madrid population, Spain." Environmental Science & Technology 41(20): 6961-6968.

The presence of 2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether; BDE -209 was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. Allen, J. G.,McClean, M. D.,Stapleton, H. M.,Nelson, J. W.,Webster, T. F. (2007). "Personal exposure to polybrominated diphenyl ethers (PBDEs) in residential indoor air." Environmental Science & Technology 41(13): 4574-4579.

[1] Brominated Flame Retardants: A Report to the Joint Standing Committee on Natural Resources, 122nd Maine Legislature, Prepared by: Maine Bureau of Health (now the Maine Center for Disease Control and Prevention) and the Maine Department of Environmental Protection, February 2005. Brominated Flame Retardants: A report to the Committee on Natural Resources, 122nd Maine Legislature, Prepared by the Center for Disease Control and Prevention and Department of Environmental Protection, February 2006. Brominated Flame Retardants: Third annual report to the Maine Legislature, Prepared by the Maine Center for Disease Control & Prevention and the Maine Department of Environmental Protection, January 2007.

2. Zhu, J.,Newhook, R.,Marro, L.,Chan, C. C. (2005). "Selected volatile organic compounds in residential air in the City of Ottawa, Canada." Environmental Science & Technology 39(11): 3964-3971.

Methyl tert-butyl ether; MTBE (CAS 1634-04-4)

Criteria for inclusion of methyl tert-butyl ether; MTBE in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of methyl tert-butyl ether; MTBE in humans was identified in 4 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
3. Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epideniology 18: 421-429.
4. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of methyl tert-butyl ether; MTBE was identified in 4 indoor air and/or dust studies (preliminary literature search).

1. Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology 41(5): 1662-1667.
2. Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City Metropolitan Area." Journal of Exposure Analysis and Environmental Epidemiology 14: S118-S132.
3. Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology 42(22): 8231-8238.
4. Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology 41: 7694-7698.

Perfluorooctanyl sulphonic acid and its salts; PFOS (CAS 1763-23-1)

Criteria for inclusion of perfluorooctanyl sulphonic acid and its salts; PFOS in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. As part of ongoing review of PFOS at MECDC, a recent scientific publication was identified that reported serum levels perfluorooctane sulfonate were positively associated with chronic kidney disease.[2] The authors examined the relation of serum PFOS (and PFOA) and chronic kidney disease in 4,587 adult participants from combined National Health and Nutritional Examination Surveys for whom serum measurements were available. The association was independent of confounders such as age, sex, race/ethnicity, body mass index, diabetes, hypertension, and serum cholesterol level. It is also noteworthy that the European Union designates PFOS as persisitent, bioaccumulative, and toxic to mammalian species, and recommends ultimate phase-out.[3]

[2] Shankar, Anoop; Jie Xiao and Alan Ducatman (2011-10-15). "Perfluoroalkyl Chemicals and Chronic Kidney Disease in US Adults". American Journal of Epidemiology 174 (8): 893–900.

[3] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:372:0032:0034:en:PDF

The presence of perfluorooctanyl sulphonic acid and its salts; PFOS in humans was identified in 5 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Fei, C.,McLaughlin, J. K.,Tarone, R. E.,Olsen, J. (2007). "Perfluorinated chemicals and fetal growth: A study within the Danish National Birth Cohort." Environmental Health Perspectives 115(11): 1677-1682.
3. Haug, L. S.,Huber, S.,Becher, G.,Thomsen, C. (2011). "Characterisation of human exposure pathways to perflourinated compounds - comparing exposure estimates with biomarkers of exposure." Environmental International 37: 687-693.
4. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
5. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of perfluorooctanyl sulphonic acid and its salts; PFOS was identified in 3 indoor air and/or dust studies (preliminary literature search).

1. Bjorklund, J. A.,Thuresson, K.,De Wit, C. A. (2009). "Perfluoroalkyl compounds (PFCs) in indoor dust: Concentrations, human exposure estimates, and sources." Environmental Science & Technology 43(7): 2276-2281.
2. Haug, L. S.,Huber, S.,Becher, G.,Thomsen, C. (2011). "Characterisation of human exposure pathways to perflourinated compounds - comparing exposure estimates with biomarkers of exposure." Environmental International 37: 687-693.
3. Shoeib, M.,Harner, T.,Webster, G. M.,Lee , S. C. (2011). "Indoor sources of poly- and perfluorinated compounds (PFCS) in Vancouver, Canada: Implications for human exposure." Environmental Science and Technology 45 (19): 7999-8005

Phenol, 4-octyl- (CAS 1806264)

Criteria for inclusion of phenol, 4-octyl- in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of phenol, 4-octyl- in humans was identified in 2 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Ye, X.,Kuklenyik, Z.,Needham, L. L.,Calafat, A. M. (2005). "Automated on-line column-switching HPLC_MS/MS method with peak focusing for the determination of nine environmental phenols in urine." Analytica Chemistry 77(16): 5407-5413.

The presence of phenol, 4-octyl- was identified in 1 indoor air and/or dust study (preliminary literature search).

1. Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting Ccmpounds in indoor air and dust." Environmental Science & Technology 37(20): 4543-4553.

2-Naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- (CAS 2425856)

Criteria for inclusion of 2-naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- in the CHC List: Canadian Environmental Protection Act – persistent bioaccumulative & inherently toxic.

The presence of 2-naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-naphthalenol, 1-[(4-methyl-2-nitrophenyl)azo]- was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

2-Ethyl-hexyl-4-methoxycinnamate (CAS 5466773)

Criteria for inclusion of 2-ethyl-hexyl-4-methoxycinnamate in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of 2-ethyl-hexyl-4-methoxycinnamate in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of 2-ethyl-hexyl-4-methoxycinnamate was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Mercury & mercury compounds (CAS 7439976)

Criteria for inclusion of mercury & mercury compounds in the CHC List: Global Harmonization System - category 1A for known reproductive or germ cell mutagenicity, California Prop65 - developmental effects (substantiated by ME-CDC review), Washington State PBT Program (confirmed by ME-CDC).

The presence of mercury & mercury compounds in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives 109(12): 1291-1299.
3. Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives 119:878-885.

The presence of mercury & mercury compounds was identified in 1 indoor air and/or dust study (preliminary literature search).

1. California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.

Nickel & nickel compounds (CAS 7440020)

Criteria for inclusion of nickel & nickel compounds in the CHC List: NTP Report on Carcinogens – nickel compounds are known human carcinogens; metallic nickel is reasonably anticipated to cause cancer I humans.

The presence of nickel & nickel compounds in humans was identified in 3 biomonitoring studies (preliminary literature search).

1. Bernhard, D.,Rossmann, A.,Henderson, B.,Kind, M.,Seubert, A.,Wick , G. (2006). "Increased serum Cadmium and Strontium Levels in Young Smokers - Effects on Arterial Endothelial Cell Gene Transcription." Arterioscler Thrombosis Vascular Biology 26:833-838.
2. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
3. Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A 73: 878-887.

The presence of nickel & nickel compounds was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in household." Reviews on Environmental Health 11(4): 179-189.
2. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.

Arsenic & Arsenic compounds (CAS 7440382)

Criteria for inclusion of arsenic & arsenic compounds in the CHC List: NTP Report on Carcinogens - known human carcinogen, EPA Integrated Risk Information System - 1986 criteria, known carcinogen, IARC - Group 1 known human carcinogen, Global Harmonization System - category 1A known human carcinogen, Global Harmonization System - category 1A for known reproductive or germ cell mutagenicity.

The presence of arsenic & arsenic compounds in humans was identified in 6 biomonitoring studies (preliminary literature search).

1. Caldwell K, Jones R, Verdon C, Jarrett J, Caudill S and Osterloh J (2008). Levels of urinary total and speciated arsenic in the US population: National Health and Nutrition Examination Survey 2003–2004. Journal of Exposure Science and Environmental Epidemiology (2009) 19, 59–68.
2. Clayton, C.,Pellizzari, E.,Quackenboss, J. (2002). "National Human Exposure Assessment Survey: Analysis of exposure pathways and routes for arsenic and lead in EPA Region 5." Journal of Exposure Analysis and Environmental Epidemiology 12(1): 29-43.
3. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
4. Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A 73: 878-887.

5. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
6. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.

The presence of arsenic & arsenic compounds was identified in 5 indoor air and/or dust studies (preliminary literature search).

1. Clayton, C.,Pellizzari, E.,Quackenboss, J. (2002). "National Human Exposure Assessment Survey: Analysis of exposure pathways and routes for arsenic and lead in EPA Region 5." Journal of Exposure Analysis and Environmental Epidemiology 12(1): 29-43.
2. Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in household." Reviews on Environmental Health 11(4): 179-189.
3. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
4. Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology 201: 1-39.
5. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.

Beryllium & Beryllium compounds (CAS 7440417)

Criteria for inclusion of beryllium & beryllium compounds in the CHC List: NTP Report on Carcinogens - known human carcinogen, EPA Integrated Risk Information System – 1996 B1 probable human carcinogen, IARC - Group 1 known human carcinogen, Global Harmonization System – Category 1A known human carcinogen.

The presence of beryllium & beryllium compounds in humans was identified in 4 biomonitoring studies (preliminary literature search).

1. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
2. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
3. Navas-Acien, A.,Francesconi, K. A.,Silbergeld, E. K.,Guallar, E. (2011). "Seafood intake and urine concentrations of total arsenic, dimethlyarsinate and arsenobetaine in the US population." Environmental Research 111: 110-118.

4. Shirai, S.,Suzuki, Y.,YOshinaga, J.,Mizumoto, Y. (2010). "Maternal exposure to low-level heavy metals during pregnancy and birth size." Journal of Environmental Science and Health Part A 45: 1468-1474.

The presence of beryllium & beryllium compounds was not identified in indoor air and/or dust studies (preliminary literature search).

Cadmium (CAS 7440-43-9)

Criteria for inclusion of cadmium in the CHC List: NTP Report on Carcinogens - known human carcinogen, IARC - Group 1 known human carcinogen

The presence of cadmium in humans was identified in 8 biomonitoring studies (preliminary literature search).

1. Bernhard, D.,Rossmann, A.,Henderson, B.,Kind, M.,Seubert, A.,Wick , G. (2006). "Increased serum Cadmium and Strontium Levels in Young Smokers - Effects on Arterial Endothelial Cell Gene Transcription." Arterioscler Thrombosis Vascular Biology 26:833-838.
2. CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.
3. Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences 23: 458-465.
4. Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A 73: 878-887.
5. Padilla, M. A.,Elobeid, M.,Ruden, D. M.,Allison, D. B. (2010). "An examination of the association of selected toxic metals with total and central obesity indices: NHANES 99-02." International Journal of Environmental Research and Public Health 7: 3332-3347.
6. Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology 11: 140-154.
7. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.
8. Shirai, S.,Suzuki, Y.,YOshinaga, J.,Mizumoto, Y. (2010). "Maternal exposure to low-level heavy metals during pregnancy and birth size." Journal of Environmental Science and Health Part A 45: 1468-1474.

The presence of cadmium was identified in 2 indoor air and/or dust studies (preliminary literature search).

1. Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in household." Reviews on Environmental Health 11(4): 179-189.
2. Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology 10: 552-565.

Quartz (CAS 14808-60-7)

Criteria for inclusion of quartz in the CHC List: IARC - Group 1 known human carcinogen, Global Harmonization System - Category 1A known human carcinogen.

The presence of quartz in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of quartz was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Butylated hydroxyanisole (CAS 25013-16-5)

Criteria for inclusion of butylated hydroxyanisole in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of butylated hydroxyanisole in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of butylated hydroxyanisole was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

Hexabromocyclododecane; HBCD (CAS 25637-99-4)

Criteria for inclusion of hexabromocyclododecane in the CHC List: Washington State PBT Program and confirmed by ME-CDC with review of peer-reviewed scientific publications. Maine CDC documents peer-reviewed studies reporting endocrine and developmental effects of HBCD, including developmental neurotoxicity in humans. Studies were also identified with data on levels of HBCD in humans.[4] It is also noteworthy that the US EPA has an action plan for HBCD based on concerns for reproductive, developmental, and neurological effects.[5]

The presence of hexabromocyclododecane in humans was identified in one biomonitoring study (preliminary literature search).

1. Covaci, A.,Gerecke, A. C.,Law, R. J.,Voorspoels, S.,Kohler, M.,Heeb, N. V.,Leslie, H.,Allchin, C. R.,Deboer, J. (2006). "Hexabromocyclododecanes (HBCDs) in the environment and humans: A review." Environmental Science & Technology 40(12): 3679-3688.

The presence of hexabromocyclododecane was identified in 2 indoor air and/or dust studies (preliminary literature search).

[4] Rationale for Concurrence by Maine Center for Disease Control and Prevention on the Designation of Brominated Flame Retardants as a Priority Chemical, November 22, 2010

[5] http://www.epa.gov/existingchemicals/pubs/actionplans/hbcd.html.

1. Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.
2. Stapleton, H. M.,Allen, J. G.,Kelly, S. M.,Konstantinov, A.,Klosterhaus, S.,Watkins, D.,McClean, M. D.,Webster, T. F. (2008). "Alternate and new brominated flame retardants detected in U.S. house dust." Environmental Science & Technology 42(18): 6910-6916.

Phenol, (1,1,3,3-tetramethylbutyl)-; Octylphenol (CAS 27193-28-8)

Criteria for inclusion of phenol, (1,1,3,3-tetramethylbutyl)-; octylphenol in the CHC List: EU Endocrine Disruptor Program - Category 1 probable.

The presence of phenol, (1,1,3,3-tetramethylbutyl)-; octylphenol in humans was not identified in biomonitoring studies (preliminary literature search).

The presence of phenol, (1,1,3,3-tetramethylbutyl)-; octylphenol was not identified in indoor air and/or dust studies (preliminary literature search).

Compound detected in consumer products.

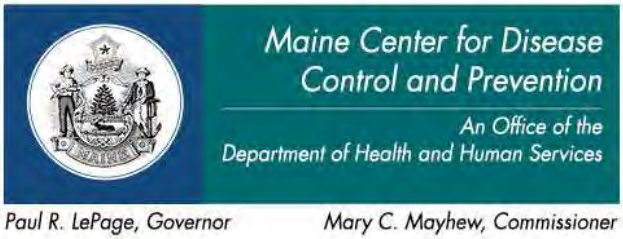
Deriving Chemicals of High Concern
Process Documentation

Appendix IV
References for Candidate Chemicals
July 1, 2012

Part 1: Toxicology References and Databases

Part 2: MECDC References for Biomonitoring and Indoor Air and Dust Exposure Candidate Chemicals for List of Chemicals of High Concern

Environmental & Occupational Health Programs
Maine Center for Disease Control and Prevention
286 Water Street, 3rd Floor, Augusta, ME 04333
207.287.4311 • 866.292.3474



Part 1: Toxicology References and Databases

California Office of Environmental Health Hazard Assessment (OEHHA) Proposition 65 List of Chemicals. CA Environmental Protection Agency.
Available at http://www.oehha.ca.gov/prop65/prop65_list/Newlist.html

Canadian Environmental Protection Act, 1999 Publication of the final decision on the screening assessment of 145 substances on the Domestic Substances List (subsection 77(6) of the Canadian Environmental Protection Act, 1999) Canadian PBiT List. Persistent, bioaccumulative and inherently toxic Available at
http://canadagazette.gc.ca/rp-pr/p1/2008/2008-06-07/html/notice-avis-eng.html#d101

European Commission (EC) Endocrine Disruptor Program. Final Report: Towards the establishment of a priority list of substances for further evaluation of their role in endocrine disruption. November 10, 2000: Annex 13. Available at
http://ec.europa.eu/environment/endocrine/strategy/substances_en.htm

Environmental Protection Agency Integrated Risk Information System (IRIS)
http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList

European Union Risk Assessment Report Tris (2-Chloroethyl) Phosphate, TCEP EINECS-No.: 204-118-5 July 2009.

European Union Commission Regulation (EU) No 757/2010 of 24 August 2010. Amending Regulation (EC) No 850/2004 of the European Parliament and of the Council on persistent organic pollutants as regards Annexes I and III. Available at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:223:0029:0036:EN:PDF

European Union Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 European Union Directive on Dangerous Substances (Directive 67/548/EEC).
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:223:0029:0036:EN:PDF

Globally Harmonized System of Classification and Labeling of Chemicals (GHS). Third revised edition United Nations 2009.
Available at http://www.unece.org/trans/danger/publi/ghs/ghs_rev03/03files_e.html

International Agency for Research of Cancer Monographs
Available at http://monographs.iarc.fr/ENG/Monographs/PDFs/index.php

National Toxicology Program Report on Carcinogens. 12th Edition. U.S. Department of Health and Human Services 2011
Available at http://ntp.niehs.nih.gov/?objectid=72016262-BDB7-CEBA-FA60E922B18C2540

NTP-CERHR Monographs on the Potential Human Reproductive and Developmental Effects. Available at http://ntp.niehs.nih.gov/?objectid=974B2C24-030F-D308-60E11D088F83FADB

Shankar A. Xiao J., Ducatman A. (2011). "Perfluoroalkyl Chemicals and Chronic Kidney Disease in US Adults". American Journal of Epidemiology 174 (8): 893–900

Stone A., Delistraty D. 2010. Sources of toxicity and exposure information for identifying chemicals of high concern to children, Environmental Impact Assessment Review, 30: 380-387.

Washington State Department of Ecology Chapter 173-333 WAC Persistent, bioaccumulative toxins (PBT) list. January 2006. Available at http://www.ecy.wa.gov/programs/swfa/pbt/list.html

Part 2: MECDC References for Biomonitoring and Indoor Air and Dust Exposure Candidate Chemicals for List of Chemicals of High Concern

Abdallah, M. A. E.,Harrad, S.,Covaci, A. (2008). "Hexabromocyclododecanes and tetrabromobisphenol-A in indoor air and dust in Birmingham, UK: Implications for human exposure." Environmental Science & Technology **42**: 6855-6861.

Adgate, J. L.,Church, T. R.,Ryan, A. D.,Ramachandran, G.,Fredrickson, A. L.,Stock, T. H.,Morandi, M. T.,Sexton, K. (2004). "Outdoor, indoor and personal exposure to VOCs in children." Environmental Health Perspectives **112**(14): 1386-1392.

Adibi, J. J.,Pepera, F. P.,Jedrychowski, W.,Camann, D. E.,Barr, D.,Jacek, R.,Whyatt, R. M. (2003). "Prenatal epposures to phthalates among women in New York City and Krakow, Poland." Environmental Health Perspectives **111**(14): 1719-1722.

Adibi, J. J.,Whyatt, R. M.,Williams, P. L.,Calafat, A. M.,Camann, D.,Herrich, R.,Nelson, H.,Bhat, H. K.,Perera, F. P.,Silva, M. J.,and Hauser, R. (2008). "Characterization of phthalate exposure among pregnant women assessed by repeat air and urine samples." Environmental Health Perspectives **116**(4): 467-473.

Allen, J. G.,McClean, M. D.,Stapleton, H. M.,Nelson, J. W.,Webster, T. F. (2007). "Personal exposure to polybrominated diphenyl ethers (PBDEs) in residential indoor air." Environmental Science & Technology **41**(13): 4574-4579.

Barr, D. B.,Barr, J. R.,Bailey, S. L.,Lapeza, C. R. J.,Beeson, M. D.,Caudill, S. P.,Maggio, V. L.,Schecter, A.,Masten, S. A.,Lucier, G. W.,Needham, L. L.,Sampson, E. J. (2000). "Levels of methyleugenol in a subset of adults in the general U.S. population as determined by hgh resolution mass spectrometry " Environmental Health Perspectives **108**(4): 323-328.

Becker, K.,Seiwert, M.,Angerer, J.,Heger, W.,Koch, H. M.,Nagorka, R.,Robkamp, E.,Schluter, C.,Seifert, B.,Ullrich, D. (2004). "DEHP matabolites in urine of children and DEHP in house dust." International journal of Environmental Health **2007**: 409-417.

Bernhard, D.,Rossmann, A.,Henderson, B.,Kind, M.,Seubert, A.,Wick , G. (2006). "Increased serum cadmium and strontium levels in young smokers - effects on arterial endothelial cell gene transcription." Arterioscler Thrombosis Vascular Biology **26**:833-838.

Bjorklund, J. A.,Thuresson, K.,De Wit, C. A. (2009). "Perfluoroalkyl compounds (PFCs) in indoor dust: Concentrations, human exposure estimates, and sources." Environmental Science & Technology **43**(7): 2276-2281.

Bornehag, C. G.,Lundgren, B.,Weschler, C. J.,Sigsfaard, T.,Hagerhed-Engman, L.,Sundell, J. (2005). "Phthalates in indoor dust and their association with building characteristics." Environmental Health Perspectives **113**(10): 1399-1404.

Calafat, A. M.,Wong, L. Y.,Silva, M. J.,Samandar, E.,Preau, J. L. J.,Jia, L. T.,Needham, L. L. (2011). "Selecting adequate exposure biomarkers of diisononyl and diisodecyl phthalates: Data

from the 2005-2006 National Health and Nutrition Examination Survey." Environmental Health Perspectives **119**(1): 50-55.

Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2008). "Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004." Environmental Health Perspectives **116**(1): 39-44.

Calafat, A. M.,Yang Wong, L.,Ye, X.,Reidy, J. A.,Needham, L. L. (2010). "Urinary concentrations of four parabens in the U.S. population: NHANES 2005-2006." Environmental Health Perspectives **118**(5): 679-685.

Caldwell K., Jones R., Verdon C., Jarrett J., Caudill S. and Osterloh J. (2008). "Levels of urinary total and speciated arsenic in the US population: National Health and Nutrition Examination Survey 2003–2004." Journal of Exposure Science and Environmental Epidemiology, 1-10.

California Air Resources Board (2005). Indoor Air Pollution in California - Report to the California Legislature. California Environmental Protection Agency.

Carlsson H., Nilsson U., Becker G., Östman C. (1997) "Organophosphate Ester Flame Retardants and Plasticizers in the Indoor Environment: Analytical Methodology and Occurrence." Environ. Sci. Technol., 1997, **31** (10), 2931–2936.

CDC (Centers for Disease Control and Prevention) (2005). Third National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.

CDC (Centers for Disease Control and Prevention) (2009). Fourth National Report on Human Exposure to Environmental Chemicals. Centers for Disease Control and Prevention, Atlanta, Ga.

Chen, G. W.,Ding, W. H.,Ku, H. Y.,Chao, H. R.,Chen, H. Y.,Huang, M. C.,Wang, S. L. (2010). "Alkylphenols in human milk and their relations to dietary habits in Central Taiwan " Food and Chemical Toxicology **48**: 1939-1944.

Clayton, C.,Pellizzari, E.,Quackenboss, J. (2002). "National Human Exposure Assessment Survey: Analysis of exposure pathways and routes for arsenic and lead in EPA Region 5." Journal of Exposure Analysis and Environmental Epidemiology **12**(1): 29-43.

Covaci, A.,Gerecke, A. C.,Law, R. J.,Voorspoels, S.,Kohler, M.,Heeb, N. V.,Leslie, H.,Allchin, C. R.,Deboer, J. (2006). "Hexabromocyclododecanes (HBCDs) in the environment and humans: A review." Environmental Science & Technology **40**(12): 3679-3688.

Damgaard, I. N.,Skakkebaek, N. E.,Toppari, J.,Virtanen, H. E.,Shen, H.,Schramm, K. W.,Petersen, J. H.,Jensen, T. K.,Main, K. M.,Group, T. N. C. S. (2006). "Persistent pesticides in human breast milk and cryptorchidism." Environmental Health Perspectives **114**(7): 1133-1138.

Elliott, L.,Longnecker, M. P.,Kissling, G. E.,London, S. J. (2006). "Volatile organic compounds and pulmonary function in the Third National Health and Nutrition Examination Survey, 1988-1994." Environmental Health Perspectives **114**(8): 1210-1214.

Fei, C.,McLaughlin, J. K.,Tarone, R. E.,Olsen, J. (2007). "Perfluorinated chemicals and fetal growth: A study within the Danish National Birth Cohort." Environmental Health Perspectives **115**(11): 1677-1682.

Fromme, H.,Lahrz, T.,Piloty, M.,Gebhart, H.,Oddoy, A.,Ruden, H. (2004). "Occurrence of phthalates and musk fragrances in indoor air and dust from apartments and kindergartens in Berlin (Germany)." Indoor Air **14**: 188-195.

Gomara, B.,Herrero, L.,Ramos, J. J.,Mateo, J. R.,Fernández, M. A.,Garcıa, J. F.,Gonzälez, M. J. (2007). "Distribution of polybrominated diphenyl ethers in human umbilical cord serum, paternal serum, maternal serum, placentas, and breast milk from Madrid population, Spain." Environmental Science & Technology **41**(20): 6961-6968.

Guan, H.,Piao, F. Y.,Li, X. W.,Li, Q. J.,Xu, L.,Yokoyama, K. (2010). "Maternal and fetal exposure to four carcinogenic environmental metals." Biomedical and Environmental Sciences **23**: 458-465.

Guo, H.,Kwok, N. H.,Cheng, H. R.,Lee, S. C.,Hung, W. T.,Li, Y. S. (2009). "Formaldehyde and volatile organic compounds in Hong Kong homes: Concentrations and impact factors." Indoor Air **19**: 206-217.

Guo, Z. Y.,Gai, P. P.,Duan, J.,Zhai, J. X.,Zhao, S. S. (2010). "Simultaneous determination of phthalates and adipates in human serum using gas chromatography-mass spectrometry with solid-phase extraction." Biomedical Chromatography **24**: 1094-1099.

Haug, L. S.,Huber, S.,Becher, G.,Thomsen, C. (2011). "Characterisation of human exposure pathways to perfluorinated compounds - comparing exposure estimates with biomarkers of exposure." Environmental International **37**: 687-693.

Hodgson, A.T., Rudd, A.F., Beal, D., Chandra, S. (2000). "Volatile organic compound concentrations and emission rates in new and site-built houses." Indoor Air **10**: 178-192.

Jones, E. A.,Wright, J. M.,Rice, C.,Buckley, B. T.,Magsumbol, M. S.,Barr, D. B.,Williams, B. L. (2010). "Metal exposures in an inner-city neonatal population." Environment International **36**: 649-654.

Just, A. C.,Adibi, J. J.,Rundle, A. G.,Calafat, A. M.,Camann, D.,Hauser, R.,Silva, M. J.,Whyyatt, R. M. (2010). "Urinary and air phthalate concentrations and self-reported use of personal care products among minority pregnant women in New York city." Journal of Exposure Science and Environmental Epidemiology **20**: 625-633.

Kerger, B. D.,Schmidt, C. E.,Paustenbach, D. J. (2000). "Assessment of airborne exposure to trihalomethanes from tap water in residential showers and baths." Risk Analysis **20**(5): 637-651.

Kim, S. R.,Halden, R. U.,Buckley, T. J. (2007). "Volatile organic compounds in human milk: Methods and measurements." Environmental Science Technology **41**(5): 1662-1667.

Kolarik, B.,Naydenov, K.,Larsson, M.,Bornehag, C. G.,Sundell, J. (2008). "The association between phthalates in dust and allergic diseases among Bulgarian children." Environmental Health Perspectives **116**(1): 98-103.

Koziel, J.,Noah, J.,Pawliszyn, J. (2001). "Field sampling and determination of formaldehyde in indoor air with solid-phase microextraction and on-fiber derivatization." Environmental Science & Technology **35**: 1481-1486.

Kutting, B.,Goen, T.,Schwegler, U.,Fromme, H.,Uter, W.,Angerer, J.,Drexler, H. (2009). "Monoarylamines in the general population - A cross-sectional population-based study including 1004 Bavarian subjects." International Journal of Hygiene and Environmental Health **212**: 298-309.

Lakind, J. S.,Naiman, D. Q.,Hays, S. M.,Aylward, L. L.,Blount, B. C. (2010). "Public health interpretation of trihalomethane blood levels in the United States: NHANES 1999-2004." Journal of Exposure Science and Environmental Epidemiology **20**: 255-262.

Lemus, R.,Abdelghani, A. A.,Akers, T. G.,Horner, W. E. (1996). "Health risk from exposure to metals in households." Reviews on Environmental Health **11**(4): 179-189.

Lin, Y. S.,Egeghy, P. P.,Rappaport, S. M. (2008). "Relationships between levels of volatile organic compounds in air and blood from the general population." Journal of Exposure Science and Environmental Epidemiology **18**: 421-429.

Liu, J.,Drane, W.,Liu, X.,Wu, T. (2009). "Examination of the relationships between environmental exposures to volatile organic compounds and biochemical liver tests: Application of canonical correlation analysis." Environmental Research **109**(2): 193-199.

Lopez-Espinosa, M. J.,Freire, C.,Arrebola, J. P.,Navea, N.,Taoufiki, J.,Fernandez, M. K.,Ballesteros, O.,Prada, R.,Olea, N. (2009). "Nonylphenol and octylphenol in adipose tissue of women in Southern Spain." Chemosphere **76**: 847-852.

Lu, Y.,Yuan, T.,Yun, S. H.,Wang, W.,Gian Wu, G.,Kannan, K. (2010). "Occurrence of cyclic and linear siloxanes in indoor dust from China, and implications for human exposures." Environmental Science Technology **44**(16): 6081-6087.

Luceri, F.,Pieraccini, G.,Moneti, G.,Dolara, P. (1993). "Primary aromatic amines from side-stream cigarette smoke are common contaminants of indoor air." Toxicology and Industrial Health **9**(3): 405-413.

Main, K.,Mortensen, G. K.,Kaleva, M. M.,Boisen, K. A.,Damgaard, I. N.,Chellakooty, M.,Schmidt, I. M.,Suomi, A. M.,Virtanen, H. E.,Petersen, J. H.,Andersson, A. M.,Toppari, J.,Skakkebæk, N. E. (2006). "Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age." Environmental Health Perspectives **114**(2): 270-276.

Miller, S. L.,Branoff, S.,Nazaroff, W. W. (1998). "Exposure to toxic air contaminants in environmental tobacco smoke: An assessment for California based on personal monitoring data." Journal of Exposure Analysis and Environmental Epidemiology **8**(3): 287-311.

Muckle, G.,Ayotte, P.,Dewailly, E.,Jacobson, S. W.,Jacobson, J. L. (2001). "Prenatal exposure of the Northern Québec Inuit infants to environmental contaminants." Environmental Health Perspectives **109**(12): 1291-1299.

Navas-Acien, A.,Francesconi, K. A.,Silbergeld, E. K.,Guallar, E. (2011). "Seafood intake and urine concentrations of total arsenic, dimethlyarsinate and arsenobetaine in the US population." Environmental Research **111**: 110-118.

Nunes, J. A.,Batista, B. L.,Rodrigues, J. L.,Caldas, N. M.,Neto, J. A. G.,Barbosa, F. J. (2010). "A simple method based on ICP-MS for estimation of background levels of arsenic, cadmium, copper, manganese, nickel, lead, and selenium in blood of the Brazilian population." Journal of Toxicology and Environmental Health, Part A **73**: 878-887.

Otake, T.,Yoshinga, J.,Yanagisawa, Y. (2001). "Analysis of organic esters of plasticizer in indoor air by GC-MS and GC-FPD." Environmental Science & Technology **35**(15): 3099-31002.

Padilla, M. A.,Elobeid, M.,Ruden, D. M.,Allison, D. B. (2010). "An examination of the association of selected toxic metals with total and central obesity indices: NHANES 99-02." International Journal of Environmental Research and Public Health **7**: 3332-3347.

Palmiotto, G.,Pieraccini, G.,Moneti, G.,Dolara, P. (2001). "Determination of the levels of aromatic amines in indoor and outdoor air in Italy." Chemosphere **43**: 355-361.

Pearce, E. N.,Leung, A. M.,Blount, B. C.,Bazrafshan, H. R.,He, X.,Pino, S.,Valentin-Blasini, L.,Braverman, L. E. (2008). "Breast milk iodine and perchlorate concentrations in lactating Boston-area women." The Journal of Clinical Endocrinology & Metabolism **92**(5): 1673-1677.

Pellizzari, E. D.,Smith, D. J.,Clayton, A.,Michael, L. C.,Quackenboss, J. J. (2001). "An assessment of the data quality for NHEXAS-Part I: Exposure to metals and volatile organic chemicals in Region 5." Journal of Exposure Analysis and Environmental Epidemiology **11**: 140-154.

Peters,R.J.B. (2005) Man-made chemicals in maternal and cord blood. TNO Report. B&O-A R 2005/129.

Ribas-Fitó, N.,Torrent, M.,Carrizo, D.,Júlvez, J.,Grimalt, J. O.,Sunyer, J. (2007). "Exposure to hexachlorobenzene during pregnancy and children's social behavior at 4 years of age." Environmental Health Perspectives **115**(3): 447-450.

Roberts, J. W.,Wallace, L. A.,Camann, D. E.,Dickey, P.,Gilbert, S. G.,Lewis, R. G.,Takaro, T. K. (2009) "Monitoring and reducing exposure of infants to pollutants in house dust." Reviews of Environmental Contamination & Toxicology **201**: 1-39.

Rodriques, J. L.,Batista, B. L.,Nunes, J. A.,Passos, C. J. S.,Barbosa, F. J. (2008). "Evaluation of the use of human hair for biomonitoring the deficiency of essential and exposure to toxic elements." Science of the Total Environment **405**: 370-376.

Rudel, R. A.,Camann, D. E.,Spengler, J. D.,Korn, L. R.,Brody, J. G. (2003). "Phthalates, alkylphenols, pesticides, polybrominated diphenyl ethers, and other endocrine-disrupting compounds in indoor air and dust." Environmental Science & Technology **37**(20): 4543-4553.

Sandau, C. D.,Ayotte, P.,Dewailly, E.,Duffe, J.,Norstrom, R. J. (2002). "Pentachlorophenol and hydroxylated polychlorinated biphenyl metabolites in umbilical cord plasma of neonates from coastal populations in Quebec." Environmental Health Perspectives **110**(4): 411-417.

Schettgen, T.,Muller, J.,Fromme, H.,Anderer, J. (2010). "Simultaneous quantification of haemoglobin adducts of ethylene oxide, propylene oxide, acrylonitrile, acrylamide and glycidamide in human blood by isotope-dilution GC/NCI-MS/MS." Journal of Chromatography B **878**: 2467-2473.

Schettgen, T.,Musiol, A.,Alt , E.,Ochsmann, E. (2009). "A Method for the quantification of biomarkers of exposure to acrylonitrile and 1, 3-butadiene in human urine by column-switching liquid chromatography- tandem mass spectrometry." Analytical and Bioanalytical Chemistry **393**: 969-981.

Schreiber, J. S.,Hudnell, H. K.,Geller, A. M.,House, D. E.,Aldous, K. M.,Force, M. S.,Langguth, K.,Prohonic, E. J.,Parker, J. C. (2002). "Apartment residents' and day care workers' exposures to tetrachloroethylene and deficits in visual contrast sensitivity." Environmental Health Perspectives **110**(7): 655-664.

Seifert, B.,Becker, K.,Helm, D.,Krause, C.,Schulz, C.,Seiwert, M. (2000). "The German Environmental Survey 1990/1992 (GerES II): Reference concentrations of selected environmental pollutants in blood, urine, hair, house dust, drinking water and indoor air." Journal of Exposure Analysis and Environmental Epidemiology **10**: 552-565.

Serrano-Trespalacios, P. I.,Ryan, L.,Spengler, J. D. (2004). "Ambient, indoor and personal exposure relationships of volatile organic compounds in Mexico City metropolitan area." Journal of Exposure Analysis and Environmental Epidemiology **14**: S118-S132.

Sexton, K.,Adgate, J. L.,Fredrickson, A. L.,Ryan, A. D.,Needham, L. L.,Ashley, D. L. (2006). "Using biologic markers in blood to assess exposure to multiple environmental chemicals for inner-city children 3 - 6 years of age." Environmental Health Perspectives **114**(3): 453-459.

Sexton, K.,Adgate, J. L.,Church, T. R.,Ashley, D. L.,Needham, L. L.,Ramachandran, G.,Fredrickson, A. L.,Ryan, A. D. (2005). "Children's exposure to volatile organic compounds as determined by longitudinal measurements in blood." Environmental Health Perspectives **113**(3): 342-348.

Shen H., Main K., Andersson A., Damgaard I, Helena E. Virtanen H., Skakkebaek E., Toppari J., and Schramm K. (2008). "Concentrations of persistent organochlorine compounds in human milk and placenta are higher in Denmark than in Finland." Human Reproduction **23** (1): 201–210.

Shoeib, M.,Harner, T.,Webster, G. M.,Lee , S. C. (2011). "Indoor sources of poly- and perfluorinated compounds (PFCS) in Vancouver, Canada: Implications for human exposure." Environmental Science and Technology **45** (19): 7999-8005

Shirai, S.,Suzuki, Y.,YOshinaga, J.,Mizumoto, Y. (2010). "Maternal exposure to low-level heavy metals during pregnancy and birth size." Journal of Environmental Science and Health Part A **45**: 1468-1474.

Stapleton, H. M.,Allen, J. G.,Kelly, S. M.,Konstantinov, A.,Klosterhaus, S.,Watkins, D.,McClean, M. D.,Webster, T. F. (2008). "Alternate and new brominated flame retardants detected in U.S. house dust." Environmental Science & Technology **42**(18): 6910-6916.

Thomsen, C.,Lundanes, E.,Becher, G. (2002). "Brominated flame retardants in archived serum samples from Norway: A study on temporal trends and the role of age." Environmental Science & Technology **36**(7): 1414-1418.

Tricker, A. R. (1997). "N-nitroso compounds and man: Sources of exposure, endogenous formation and occurrence in body fluids." European Journal of Cancer Prevention **6**: 226-268.

Vesper, H. W.,Caudill, S. P.,Osterloh, J. D.,Meyers, T.,Scott, D.,Myers, G. L. (2010). "Exposure of the U. S. population to acrylamide in the National Health and Nutrition Examination Survey 2003- 2004." Environmental Health Perspectives **118**(2): 278-283.

Weisel, C. P.,Alimokhtari, S.,Sanders, P. F. (2008). "Indoor air VOC concentrations in suburban and rural New Jersey." Environmental Science & Technology **42**(22): 8231-8238.

Weuve, J.,Hauser, R.,Calafat, A. M.,Missmer, S. A.,Wise, L. A. (2010). "Association of exposure to phthalates with endometriosis and uterine leiomyomata: Findings from NHANES, 1999-2004." Environmental Health Perspectives **118**(6): 825-832.

Wolff, M. S.,Teitelbaum, S. L.,Windham, G.,Pinney, S. M.,Britton, J. A.,Chelimo, C.,Godbold, J.,Biro, F.,Kushi, L. H.,Pfeiffer, C. M.,Calafat, A. M. (2007). "Pilot study of urinary biomarkers

of phytoestrogens, phthalates, and phenols in girls." Environmental Health Perspectives **115** (1): 116-121.

Woodruff, T.J., Zota, A.R., Schartz, J.M. (2011). Environmental chemicals in pregnant women in the United States: NHANES 2003-2004. Environmental Health Perspectives **119**:878-885.

Yazbeck, C.,Kloppmann, W.,Cottier, R.,Sahuquillo, J.,Debotte, G.,Huel, G. (2005). "Health impact evaluation of boron in drinking water: a geographical risk assessment in Northern France." Environmental Geochemistry and Health **27**: 419-427.

Ye, X., Bishop, A.M., Needham, L.L., Calafat, A.M. (2008). Automated on-line column-switching HPLC-MS/MS method with peak focusing for measuring parabens, triclosan, and other environmental phenols in human milk. Analytica Chimica Acta **622**:150-156.

Ye, X.,Kuklenyik, Z.,Bishop, A. M.,Needham, L. L.,Calafat, A. M. (2006). "Quantification of the urinary concentrations of parabens in humans by on-line solid phase extraction-high performance liquid chromatography-isotope dilution tandem mass spectrometry." Journal of Chromatography B **844**: 53-59.

Ye, X.,Kuklenyik, Z.,Needham, L. L.,Calafat, A. M. (2005). "Automated on-line column-switching HPLC_MS/MS method with peak focusing for the determination of nine environmental phenols in urine." Analytica Chemistry **77**(16): 5407-5413.

Zhang, J.,Wilson, W. E.,Lioy, P. J. (1994). "Sources of organic acids in indoor air: a field study." Journal of Exposure Analysis and Environmental Epidemiology **4**(1): 25-47.

Zhu, J.,Laifeng, Y.,Shoeib, M. (2007). "Detection of dechlorane plus in residential indoor dust in the city of Ottawa, Canada." Environmental Science & Technology **41**: 7694-7698.

Zhu, J.,Newhook, R.,Marro, L.,Chan, C. C. (2005). "Selected volatile organic compounds in residential air in the City of Ottawa, Canada." Environmental Science & Technology **39**(11): 3964-3971.

PATRICIA W. AHO
COMMISIONER

APPENDIX V

Chemicals of High Concern

Maine Department of Environmental Protection
Process Documentation for
Investigating Chemical Presence in Consumer Products

June 29, 2012

Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333-0017
(207) 287-7688

Review Process

Maine law requires that development of Maine's list of Chemicals of High Concern (CHC) is to be cooperatively determined by the Maine Department of Health and Human Services, Maine Center for Disease Control and Prevention ("Maine CDC"), and the Maine Department of Environmental Protection ("Department"). (38 M.R.S.A. § 1693-A(1)). An agreement of shared responsibility for research of chemical classification criteria was established between the agencies. The Department assumed responsibility for research of evidence that chemicals are present in consumer products. Evidence of presence in consumer products exists if "…the chemical has been added to or is present in a consumer product used or present in the home." (38 M.R.S.A. § 1693-A(2)(C)).

The Department undertook an extensive review of publically available resources meeting the "credible scientific evidence" standard detailed in law. Maine law requires strong, credible scientific evidence as the standard for classifying chemicals of high concern and defines credible scientific evidence as, "the results of a study, the experimental design and conduct of which have undergone independent scientific peer review, that are published in a peer-reviewed journal or publication of an authoritative federal or international governmental agency…" (38 M.R.S.A. § 1691 (8-A)). Chemicals from the Maine chemicals of concern list meeting the criteria of evidence of presence in consumer products based upon the literature review were documented in the CHC list (details are provided in the Department's chemical candidate spreadsheet).

The Danish Environmental Protection Agency (DEPA) has a comprehensive consumer product chemical analysis program. Due to the comprehensive nature of the program and the analysis, the Department cites this reference extensively and includes the individual summary report numbers on the spreadsheet of candidate chemicals published on the Department's website (which includes citations for each reference described here).

References

The Department utilized the following references in the evaluation of the list of candidate chemicals for presence in consumer products:

Chemical Assessment and Management Program (ChAMP)

The Chemical Assessment and Management Program (ChAMP) is no longer updated, and was superseded by other initiatives in 2009. Under ChAMP, the U.S. EPA evaluated and assigned priority for follow-up action on high production volume (HPV) and medium production volume (MPV) chemicals. EPA produced a number of monograghs for a limited number of chemicals that included information on chemical properties, toxicity, and in some instances product information.

Danish Environmental Protection Agency (DEPA)

The Danish Environmental Protection Agency (DEPA) conducts a consumer products program. This includes a series of reports on chemicals present in consumer products as tested by the Danish EPA. This database was used to identify chemicals in children's and other household products. All Danish Ministry of the Environment references may be found at the end of this document and at the following internet address: [http://www.mst.dk/English/Chemicals/consumers_consumer_products/]

Dutch Reports

The Netherlands Food and Consumer Product Safety Authority (NL) monitors food and consumer products to safeguard public health. This Authority controls entire production chains, from raw materials and processing aids, to end products and consumption. Dutch references cited may be found at the end of this document and at following internet address: [http://www.vwa.nl/]

Environmental Health Perspectives (EHP)

A monthly journal of peer-reviewed research and news, EHP is published by the U.S. National Institute of Environmental Health Sciences, National Institutes of Health, and the Department of Health and Human Services. EHP serves as a forum for the discussion of the interrelationships between the environment and human health by publishing peer-reviewed research in a balanced and objective manner. EHP is the third-ranked monthly journal in environmental sciences. Receiving more than 1,200 research manuscripts each year, EHP has an acceptance rate of 22%. Research articles are published within 24 hours of acceptance as Ahead of Print (AOP) articles and are citable using the CrossRef DOI system. [http://dx.doi.org/10.1289/ehp.1104052]

Environmental Science and Technology (ES&T)

Published peer-reviewed studies provide added value to Maine's exposure research, to the extent that more current data strengthens evidence and develops the analysis of predetermined data sets. ES&T is an authoritative source of information utilized by a wide range of environmental disciplines. ES&T publishes original research, which is reviewed by the editor and other scientists who assess the significance, originality, and validity of the work, as well as its appropriateness for publication. Widely utilized as a reference across disciplines, ES&T ranks number one in total citations in the Environmental Engineering and Environmental Sciences categories (as reported by the 2010 Journal Citation Reports®). ES&T studies referenced are cited at the end of this document.

EPA Inventory Use and Reporting (IUR) Database

The IUR database, now known as Chemical Data Reporting (CDR), collects quality screening-level, exposure-related information on chemical substances and makes this information available for use by the U.S. EPA and the public. The CDR data are used to support risk screening assessment, priority setting and management activities, and constitute the most comprehensive source of basic screening-level, exposure-related information on chemicals available to the EPA. The CDR data bank may be found at the following internet address: [http://epa.gov/iur/index.html]

ESIS Risk Assessment Reports

The ESIS (European chemical Substances Information System) of the European Commission Joint Research Centre Institute for Health and Human Protection is a complex, heterogeneous information system that provides information on chemicals. Several aspects of the ESIS system are managed by the European Chemicals Agency (ECHA). This resource was used to identify chemical use in consumer products by review of Risk Assessment Reports (RAR). The ESIS website may be found at the following internet address: [http://esis.jrc.ec.europa.eu/]

German Federal Environment Agency (German FEA)

The German Federal Environment Agency (Umwelt Bundes Amt (UBA)) was founded within Germany's central federal authority on environmental matters and is the scientific environmental authority under the jurisdiction of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety. The UBA is mandated to provide scientific support to the Federal Government of Germany, implement environmental laws, and inform the public regarding environmental protection efforts; experts within the UBA utilize in-house laboratories, in addition to commissioning research to scientific institutions. The agency has adopted an interdisciplinary approach in its activities, to include economists, chemists, biologists, and legal experts working in unison to outline whole solutions to environmental risks. The UBA is an acting partner for many of Germany's international organizations, including the World Health Organization. The UBA report reference may be found at the end of this document and at the following internet address: [http://www. umweltbundesamt.de/]

Hazardous Substances Data Bank

The Hazardous Substances Data Bank (HSDB) of the National Library of Medicine is a toxicology data file that focuses on the toxicology of potentially hazardous chemicals. All data are referenced and derived from a core set of books, government documents, technical reports and selected primary journal literature. HSDB is peer-reviewed by the Scientific Review Panel

(SRP), a committee of experts in the major subject areas within the data banks scope. The HSDB data bank may be found at the following internet address: [http://toxnet.nlm.nih.gov]

Household Products Database

The Household Products Database (HPD) is sponsored by the National Library of Medicine, uses information gathered from publicly available sources. Neither NLM nor its contractor (Database Providers) test products or investigate to determine if information listed is complete or accurate. The HPD database may be found at the following internet address: [http://hpd.nlm.nih.gov/]

Substances in Products in the Nordic Countries (SPIN)

SPIN is a database formulated by the combination of the Product Registries of Norway, Sweden, Denmark, and Finland. Financed by the Nordic Council of Ministers Chemical Group, the database provides information about the chemical compounds register. National legislation in these Nordic Countries requires manufacturers and importers to declare chemical substances and products to the product registers. Data compiled in the registers includes information on chemical function, industrial category, classification, composition, and quality. These registers provide a valuable reference for national authorities, and are generally used as support for risk assessments, statistical calculations, substance flow analysis, supervision activities, as well as poison information centers. SPIN is the result of a common Nordic initiative to gather non-confidential information from the Nordic product registers on the common use of chemical substances in different types of products and industrial areas. No specific product names are included within the data stored in SPIN, only the identity of commonly used chemical substances, their inherent properties and the product categories they are reported to have been used in are specified. It should be noted that each country comprising the Nordic group producing SPIN does not require registration of information equally. Denmark and Norway require information on all constituents for the products which mandate a declaration of ingredients. The Swedish government provides a provision allowing substances that are not classified as dangerous and make up less than 5% of a product to be omitted from the declaration of information. Finland registers information on the composition of products from safety data sheets. Therefore, complete information on the exact composition of all product categories is, consequently, not necessarily provided within SPIN. The SPIN database may be found at the following internet address: [http://188.183.47.4/dotnetnuke/Home/tabid/58/Default.aspx]

U.S. EPA Toxic Substances Control Act (TSCA) Work Plan Chemicals

The U.S. EPA uses its statutory authorities, including TSCA, as well as voluntary activities in implementing programs that address pollution prevention, risk assessment, hazard and exposure assessment and characterization, and risk management for chemical substances in commercial use. The U.S. EPA has evolved its approach to its chemicals management program to include an identified group of TSCA Work Plan Chemicals ("Work Plan") for risk assessment under TSCA. The screening process for identifying chemicals for the Work Plan list include the following factors: potentially of concern to children's health; neurotoxic effects; persistent, bioaccumulative, and toxic; probable or known carcinogens; used in children's products; detected in biomonitoring programs. In March 2012, the U.S. EPA identified a work plan of 83 chemicals for further assessment under TSCA, seven of these for risk assessment during the year 2012. Each of the 83 chemicals identified in the Work Plan scored high in this screening process based on their combined hazard, exposure, and persistence and bioaccumulation characteristics. The TSCA Work Plan Chemicals may be found at the following internet address: [http://www.epa.gov/opptintr/existingchemicals/pubs/workplan.html]

Voluntary Children's Chemical Evaluation Program (VCCEP)

This program, sponsored by the U.S. EPA, asks companies that manufacture or import selected chemicals, to voluntarily provide information on health effects, exposure, risk, and data needs. Companies involved collect and/or develop health effects and exposure information on their selected chemical(s) and integrate that information in a risk assessment. The VCCEP data referenced may be found at the following internet address: [http://www.epa.gov/oppt/vccep/]

Published Report and Journal References

Denmark

Danish Ministry of the Environment, Environmental Protection Agency. Tonning, Kathe; Jacobsen, Eva; Pedersen, Eva; Nilsson, Nils; and The Danish Technological Institute. "Phthalates in products that children are in direct contact with." *Survey of chemical substances in consumer products*, No. 109 (2010).

Danish Ministry of the Environment, Environmental Protection Agency. Tonning, Kathe; Jacobsen, Eva; Pedersen, Eva; Nilsson, Nils; and The Danish Technological Institute. "Phthalates in products with large surfaces." *Survey of chemical substances in consumer products*, No. 108 (2010).

Danish Ministry of the Environment, Environmental Protection Agency. Tonning, Kathe; Malmgren-Hansen, Bjorn; Jacobsen, Eva; Pedersen, Eva; Nilsson, Nils; and The Danish Technological Institute. "Phthalates in plastic sandals." *Survey of chemical substances in consumer products*, No. 107 (2010).

Danish Ministry of the Environment, Environmental Protection Agency. Andersen, Thrine; Rasmussen, Dorte; Cohr, Karl-Heinz; and The Danish Institute for Water and Environment, Nylen, Dorte and The Danish Toxicology Centre. "Survey of chemical substances in cleaning products for ovens, cookers and ceramic cooktops." *Survey of chemical substances in consumer products*, No. 106 (2010).

Danish Ministry of the Environment, Environmental Protection Agency. Tonning, Kathe; Jacobsen, Eva; Pedersen, Eva; Brunn Pedersen, Pia and FORCE Technology. "Survey and Health Assessment of Products for Interior Car Care." *Survey of chemical substances in consumer products*, No. 105 (2010).

Danish Ministry of the Environment, Environmental Protection Agency. Tonning, Kathe; Jacobsen, Eva; Pedersen, Eva and The Danish Technological Institute; Brunn Pedersen, Pia; Strange, Marianne and FORCE Technology; Moller, Lise; Boyd, Helle and DHI (Danish Institute for Water and Environment). "Survey and Health Assessment of the exposure of 2 year-olds to chemical substances in Consumer Products." *Survey of chemical substances in consumer products*, No. 102 (2009).

Danish Ministry of the Environment, Environmental Protection Agency. Cited using summary available at: [http://www.mst.dk]. "Survey of nickel migration from mobile phones; Five mobile phones release more nickel than the limit." *Survey of chemical substances in consumer products*, No. 101 (2009).

Danish Ministry of the Environment, Environmental Protection Agency. Nilsson, Nils; Malmgren-Hansen, Bjorn; Sognstrup, Uffe; and The Danish Technological Institute. "Mapping, emissions and environmental and health assessment of chemical substances in artificial turf." *Survey of chemical substances in consumer products*, No. 100 (2008).

Danish Ministry of the Environment, Environmental Protection Agency. Feilberg, Anders; Tonning, Kathe; Jacobsen, Eva; Hemmersam, Anne-Gry and The Danish Technological Institute; Soberg, Inge; Cohr, Karl-Heinz and The Danish Institute for Water and Environment. "Survey and Health Assessment of Possible Health Hazardous Compounds in Proofing Sprays." *Survey of chemical substances in consumer products*, No. 98 (2008).

Danish Ministry of the Environment, Environmental Protection Agency. Norgaard, Dorthe; Sorensen, Hanne; Larsen, Jette; Cohr, Karl-Heinz and The Danish Institute for Water and Environment; Andersen, Jorgen; Analycen, Lantmannen. "Survey and safety assessment of Chemical substances in artificial nails and nail hardeners." *Survey of chemical substances in consumer products*, No. 95 (2008).

Danish Ministry of the Environment, Environmental Protection Agency. Strandesen, Maria; Poulsen, Pia and FORCE Technology. "Survey and health assessment of chemical substances in jewelleries." *Survey of chemical substances in consumer products*, No. 94 (2008).

Danish Ministry of the Environment, Environmental Protection Agency. Lassen, Carsten; Havelund, Sven; Mikkelsen, Sonja and COWI; Bondgaar, Inge and Eurofins; Silberschmidt, Martin and ms consult. "Survey and Health Assessment chemical substances in essential oils and fragrance oils." *Survey of chemical substances in consumer products*, No. 92 (2008).

Danish Ministry of the Environment, Environmental Protection Agency. Tonning, Kathe; Pedersen, Eva; Drojdahl, Anette; Malmgren-Hansen, Bjorn; Woin, Per; Moller, Lise; Bernth, Nils and The Danish Technological Institute. "Survey, emission and health assessment of chemical substances in baby products." *Survey of chemical substances in consumer products*, No. 90 (2008).

Danish Ministry of the Environment, Environmental Protection Agency. Nilsson, Nils and The Danish Technology Institute. "Analysis of chemical substances in balloons." *Survey of chemical substances in consumer products*, No. 89 (2007).

Danish Ministry of the Environment, Environmental Protection Agency. Poulsen, Pia; Schmidt, Anders and FORCE Technology. "Survey and Health Assessment of cosmetic products for children." *Survey of chemical substances in consumer products*, No. 88 (2007).

Danish Ministry of the Environment, Environmental Protection Agency. Poulsen, Pia; Svendsen, Nanna; Bjarnov, Erik and FORCE Technology. "Survey as well as health assessment of chemical substances in school bags, toy bags, pencil cases and erasers." *Survey of chemical substances in consumer products*, No. 84 (2007).

Danish Ministry of the Environment, Environmental Protection Agency. Hansen, Paul; Tonning, Kathe; Pommer, Kristen; Malmgren-Hansen, Bjorn; Hansen, Ole; Poulsen, Mikael, and The Danish Technological Institute. "Survey and Health risk assessment of products for treatment of sports injuries and pains." *Survey of chemical substances in consumer products*, No. 79 (2006).

Danish Ministry of the Environment, Environmental Protection Agency. Hansen, Paul; Tonning, Kathe; Pommer, Kristen; Malmgren-Hansen, Bjorn and The Danish Technological Institute. "Survey and health assessment of chemical substances in pleasure gel." *Survey of chemical substances in consumer products*, No. 76 (2006).

Danish Ministry of the Environment, Environmental Protection Agency. Jensen, Allan and FORCE Technology; Knudsen, Henrik and SBi-Danish Building Research Institute. "Total health assessment of chemicals in indoor climate from various consumer products." *Survey of chemical substances in consumer products*, No. 75 (2006).

Danish Ministry of the Environment, Environmental Protection Agency. Borling, Pernille; Engelund, Birgit; Sorensen, Hanne; Cohr, Karl-Heinz, and Danish Technological Institute Health and Environment, business unit of DHI Water and Environment. "Survey, migration and health evaluation of chemical substances in toys and childcare products produced from foam plastic." *Survey of chemical substances in consumer products*, No. 70 (2006).

Danish Ministry of the Environment, Environmental Protection Agency. Larsen, Jette and The Danish Toxicology Centre; Andersen, Trine and DHI Water and Environment. "Survey of liquid hand soaps, including health and environmental assessments." *Survey of chemical substances in consumer products*, No. 69 (2006).

Danish Ministry of the Environment, Environmental Protection Agency. Glensvig, Dorte and COWI A/S; Ports, Jane and Eurofins Denmark A/S. "Mapping of perfume in toys and children's articles." *Survey of chemical substances in consumer products*, No. 68 (2006).

Danish Ministry of the Environment, Environmental Protection Agency. Svendsen, Nanna; Pedersen, Soren; Hansen, Ole; Pedersen, Eva; Bernth, Nils and The Danish Technological Institute. "Survey and release of chemical substances in 'slimy' toys." *Survey of chemical substances in consumer products*, No. 67 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Mortensen, Peter and Eurofins A/S. "Emission and evaluation of chemical substances from selected electrical and electronic products – part 2." *Survey of chemical substances in consumer products*, No. 66 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Bernth, Nils; Hansen, Ole; Hansen, Steen; Pedersen, Eva and Teknologisk Institut. "Survey of chemical substances in kohl and henna products." *Survey of chemical substances in consumer products*, No. 65 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Hansen, Ole; Pedersen, Eva and The Danish Technological Institute. "Migration and health assessment of chemical substances in surface treated wooden toys." *Survey of chemical substances in consumer products*, No. 60 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Egmose, Kurt; Pors, Jane and Eurofins. "Survey of chemical substances in textile colorants." *Survey of chemical substances in consumer products*, No. 58 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Hansen, Ole and The Danish Technological Institute. "Screening for health effects from chemical substances in textile colorants." *Survey of chemical substances in consumer products*, No. 57 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Nielsen, Tenna; Bjarnov, Erik; Bundgaard, Ole and FORCE Technology. "Survey of chemical substances in toys for animals." *Survey of chemical substances in consumer products*, No. 56 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Larsen, Jette; Holmberg, Rikke. "Survey of lip care products with fragrance and flavour." *Survey of chemical substances in consumer products*, No. 55 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Nilsson, Nils; Feilberg, Anders; Pommer, Kirsten and The Danish Technological Institute. "Emissions and evaluation of health effects of PAH's and aromatic mines from tyres." *Survey of chemical substances in consumer products*, No. 54 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Ankjaergaard, Claus. "Survey of chemical substances in dandruff shampoo." *Survey of chemical substances in consumer products*, No. 53 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Engelund, Birgit; Sorensen, Hanne and The Danish Toxicology Centre. "Mapping and health assessment of chemical substances in shoe care products." *Survey of chemical substances in consumer products*, No. 52 (2005).

Danish Ministry of the Environment, Environmental Protection Agency. Nilsson, Nils; Pedersen, Vibeke and The Danish Technological Institute. "Mapping and release of chemical substances from products made of chloroprene." *Survey of chemical substances in consumer products*, No. 51 (2004).

Danish Ministry of the Environment, Environmental Protection Agency. Witterseh, Thomas and Danish Technological Institute. "Emission of chemical substances from products made of exotic wood" *Survey of chemical substances in consumer products*, No. 49 (2004).

Danish Ministry of the Environment, Environmental Protection Agency. Hansen, John; Hansen, Ole; Pommer, Kirsten and The Danish Technological Institute. "Release of chemical substances from tens and tunnels for children." *Survey of chemical substances in consumer products*, No. 46 (2004).

Danish Ministry of the Environment, Environmental Protection Agency. Svendsen, Nanna; Pedersen, Soren; Hansen, Ole; Mossing, Jakob; Bernth, Nils and The Danish Technological Institute. "Survey of chemical substances in toothbrushes." *Survey of chemical substances in consumer products*, No. 42 (2004).

Danish Ministry of the Environment, Environmental Protection Agency. Dilani, Anne; Nielsen, Anders; Feilberg, Anders; Hansen, Paul; Pommer, Kirsten and The Danish Technological Institute. "Survey of fluorescent substances in consumer products." *Survey of chemical substances in consumer products*, No. 40 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Eggert, Torben; Hansen, Ole and The Danish Technological Institute. "Survey and emission of chemical substances from incense." *Survey of chemical substances in consumer products*, No. 39 (2004).

Danish Ministry of the Environment, Environmental Protection Agency. Nilson, Nils; Pedersen, Soren; Hansen, Paul; Christensen, Ivan and The Danish Technological Institute. "Survey and liberation of chemical substances in joint sealants." *Survey of chemical substances in consumer products*, No. 38 (2004).

Danish Ministry of the Environment, Environmental Protection Agency. Hansen, Ole; Eggert, Torben and The Danish Technological Institute. "Survey, emission and evaluation of volatile organic chemicals in prineted matter." *Survey of chemical substances in consumer products*, No. 36 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Abildgaard, Anne; Mikkelsen, Sonja; Stuer-Lauridsen, Frank and COWI. "Survey of Chemical Substances in Paper Handkerchiefs and Toilet Paper." *Survey of chemical substances in consumer products*, No. 34 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Abildgaard, Anne; Mikkelsen, Sonja; Stuer-Lauridsen, Frank and COWI. "Survey of Chemical Substances in Paper Handkerchiefs and Toilet Paper." *Survey of chemical substances in consumer products*, No. 34 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Ferdinand, Jacob; Kaysen, Ole; Petersen, Lause and Econet AS. "Report of Natural Toys Made of Plan Fibres, Woollen Fibres and Solid Wood." *Survey of chemical substances in consumer products*, No. 33 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. The Danish Technological Institute: Malmgren-Hansen, Bjorn; Olesen, Steen; Pommer, Kirsten; Funch, Lis; Pedersen, Eva; and Technical University of Denmark: Willum, Ole; Olsen, Stig. "Emission and evaluation of chemical substances from selected electrical and electronic products." *Survey of chemical substances in consumer products*, No. 32 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Nilsson, Nil; Jensen, Malene and Danish Technological Institute – Centre for Environment and Waste. "Survey and assessment of chemical substances in hobby adhesives." *Survey of chemical substances in consumer products*, No. 29 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Pors, Jane; Fuhlendorff, Rene. "Mapping of chemical substances in earplugs, Phase 2: Analysis of substances." *Survey of chemical substances in consumer products*, No. 28 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Laursen, Soren; Sansen, John; Drojdahl, Anette; and The Danish Technological Institute, Clothing and Textile; Hansen, Ole; Pommer, Kirsten; and The Danish Technological Institute, Environmental and Waste Technology; Pedersen, Eva; Bernth, Nils; and The Danish Technological Institute, Chemical Technology. "Survey of chemical compounds in textile fabrics." *Survey of chemical substances in consumer products*, No. 23 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Glensvig, Dorte and COWI A/S; Mortensen, Peter and Eurofins Danmark A/S. "Mapping of chemicals in dry-cleaned textiles from Rynex and hydrocarbon dry-cleaning shops." *Survey of chemical substances in consumer products*, No. 21 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Lundskov, Birgit; Pedersen, Anne; Andersen, Erik; and The Danish Technological Institute, Chemical Department. "Investigation of chemical substances in products containing decorative liquids." *Survey of chemical substances in consumer products*, No. 20 (2003).

Danish Ministry of the Environment, Environmental Protection Agency. Laursen, Jette; Trap, Lone; and Chemtox A/S. "Survey of chemical substances in consumer products." *Survey of chemical substances in consumer products*, No. 19 (2002).

Danish Ministry of the Environment, Environmental Protection Agency. Kristensen, Lene; Jorgensen, Lis; Lindgren, Erik; Waksman, Peter; and Altox A/S. "An investigation of chemical substances in 'do it yourself' cosmetics." *Survey of chemical substances in consumer products*, No. 10 (2002).

Danish Ministry of the Environment, Environmental Protection Agency. Eggert, Torben; Bodker, Jorn; Hansen, Ole. "Chemical ingredients in candles sold in Danish retail shops." *Survey of chemical substances in consumer products*, No. 06 (2002).

Danish Ministry of the Environment, Environmental Protection Agency. Pors, Jane; Fuhlendorff, Rene. "Phthalates and organic tin compounds in PVC products." *Survey of chemical substances in consumer products*, No. 01 (2001).

Netherlands

Dutch Inspectorate for Health Protection and Veterinary Public Health. Bouma, K.; Nab, F.M.; "Teats and Soothers: Migration of nitrosamines, nitrosatable substances and 2-Mercaptobenzthiazol (MBT), Screening of other migrants, Mechancical safety of soothers." Report Number: NDTOY003/01, (2002).

Dutch Inspectorate for Health Protection and Veterinary Public Health. "Migration of N-nitrosamines and N-nitrosatable Substances from Latex Balloons." Report Number: ND04o063/02, (2005)

Dutch Food and Consumer Product Safety Authority. Bouma, K.; Reus, H.R; "Market Surveillances on Toy Safety: Isophoron and phenol in floatable toys, Lead and cadmium in wooden toys, Wood preservatives in wooden toys, Azo dyes in textile toys, Flammability of textile toys." Report Number: ND04o063/01, (2004)

Dutch Food and Consumer Product Safety Authority. "Screening of Plastic Toys for Chemical Compositi8on and Hazards: Market Surveillance in the Netherlands." Report Number: ND05o610/01 (2005).

Dutch Food and Consumer Product Safety Authority. "Cosmetische protucten voor kinderen: Inventarisatie van de markt en de veilgheidsborging door produceten en importeurs (Summary in English)." Report Number: ND04o065/ND05o170, (2007).

Germany

German Federal Environment Agency (Umweltbundesamt), Federal Ministry of the Environment, Nature Conservation and Nuclear Safety. Kalberla, Fritz; Schwartz, Markus. "Substances classified as carcinogenic, mutagenic and toxic for reproduction (CMR) and other substances of concern in consumer products." Report No. (UBA-FB) 001434, (2011).

Publications

Stapleton, Heather et al (2011). "Identification of Flame Retardants in Polyurethane Foam Collected from Baby Products." Environmental Science & Technology, **45**: 5323-5331.

Apelberg, Benjamin et al (2007). "Determinants of Fetal Exposure to Polyfluoroalkyl Compounds in Baltimore, Maryland." Environmental Science & Technology, **41**: 3891-3897.

Lincoln, John et al (2007). "Leaching Assessments of Hazardous Materials in Cellular Telephones." Environmental Science & Technology, **41**: 2572-2578.

Washburn, Stephen et al (2005). "Exposure Assessment and Risk Characterization for Perflurooctanoate in Selected Consumer Articles." Environmental Science & Technology, **39**: 3904-3910.

Dodson, Robin et al (2012). "Endocrine Disruptors and Asthma-Associated Chemicals in Consumer Products." Environmental Health Perspectives, http://dx.doi.org/10.1289/ehp.1104052.