

Phase 1

Introduction

There are tens of thousands of chemicals in use in commerce today. We know about the toxicity of only a small percentage of these chemicals and even less about the potential for children to be exposed to these chemicals from products. Nevertheless, there are still thousands of chemicals that we knew we would need to assess.

Our first challenge was to find a way to identify which of these thousands of chemicals meet the criteria established in the CSPA as chemicals of high concern for children. And, with only limited resources to put toward this effort, we knew we would need to build upon the work of others.

Our approach has three phases: building; prioritizing; vetting. The first phase was intended to cast a wide net and build an inclusive list of chemicals that we could then refine. This section describes in detail the first phase. An overview of the entire process is described in the executive summary.

Phase 1: Identifying Potential CHCCs

The Children's Safe Products Act (CSPA, Chapter 70.240 RCW) requires Ecology, in consultation with the Department of Health (DOH), to develop a list of high priority chemicals of high concern for children (CHCCs) that will trigger the reporting requirement for manufacturers of children's products.

CSPA establishes that a CHCC must meet both of the following criteria (see Figure 1):

- Chemicals that meet the definition of a high priority chemical [RCW 70.240.010(6)]; **AND**
- Chemicals that are found in humans or that have a potential exposure route to children [RCW 70.240.030]

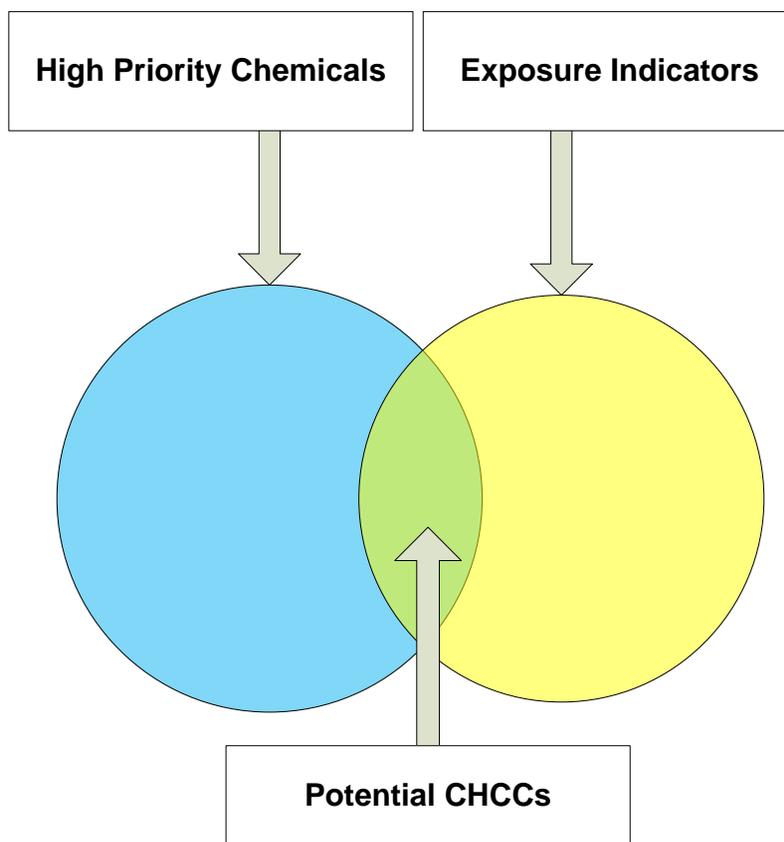


Figure 1 - Potential CHCCs must be both an HPC and have potential exposure

The purpose of Phase 1 was to identify chemicals that meet both of these criteria to produce a list of Potential CHCCs, and refine that list to determine which of these chemicals will undergo further assessment and prioritization. Phase 1 was conducted in three steps, detailed below:

- Step 1: Screen for High Priority Chemicals
- Step 2: Screen for Potential Exposure Indicators
- Step 3: Refine CHCCs

Limitations

The approach used in Phase 1 is subject to the larger limitations of data availability that are common to all efforts to research and regulate chemicals. Most chemicals in use today are not well-studied with regard to toxicity or exposure. Ecology relied on authoritative government sources and peer-reviewed journal articles for its data in each case. However, these are not the only sources available nor was each source searched exhaustively.. Moreover, it is generally acknowledged that data on exposure to chemicals, especially through use of consumer products, is less well-developed than data on the toxicity of chemicals.

Further, for reasons discussed below we removed a number of chemicals from consideration in this phase. It would not have been possible to expediently evaluate the large number of potential CHCCs for inclusion on the list without these targeted removals. We may reconsider these chemicals as part of future revisions of the list of CHCCs.

Step 1: Screening High Priority Chemicals

High Priority Chemicals (HPCs) are defined in CSPA (76.240.010 (6)) as follows:

(6) "High priority chemical" means a chemical identified by a state agency, federal agency, or accredited research university, or other scientific evidence deemed authoritative by the department on the basis of credible scientific evidence as known to do one or more of the following:

- (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; or*
- (f) Be very persistent and very bioaccumulative.*

With tens of thousands of chemicals in use today, Ecology began the process of identifying HPCs by relying on the authoritative work of governmental agencies as the primary source of information. Because government sources identifying neuro-toxicants are not available, Ecology turned to peer-reviewed data published in the scientific literature. Table 1 lists the information sources used to identify HPCs that meet these criteria. Details on these sources are found in the reference section.

This initial step resulted in a list of 2,164 chemicals.

Table 1: Authoritative sources to identify HPCs.

United States: Federal*	EPA TRI PBT Chemicals
	EPA VCCEP
	Nat. Waste Minimization Program Priority Chemical
	Nat. Tox Program Reproduction
	Nat. Tox Program Carcinogens-Known
	Nat. Tox Program Carcinogens-Suspected
	IRIS Total
	IRIS 1986 Category A (known)
	IRIS 1986 Category B1 (probable-based on human data)
	IRIS 1986 Category B2 (probable-based on human and animal)
	IRIS 1986 Category C (possible)
	IRIS 1996 Known/likely
	IRIS 1999 Carcinogens
	IRIS 2005 Suggestive Evidence
IRIS Other Chemicals included in IRIS with primarily non-cancer effects	
United States: State	CA Prop 65-Total
	Prop 65 Cancer
	Prop 65 Developmental
	Prop 65 Female
	Prop 65 Male
	WA PBTs
International: Europe	EU Endocrine Disruptors Cat 1
	EU Endocrine Disruptors Cat 2
	EU SVHC (Substances of Very High Concern)
	EU PBTs
	EU Chemicals identified for Risk Assessment
	OSPAR Chemicals of Concern
	OSPAR 1997 Chemicals for Priority Action
	IARC Group 1 Known Carcinogens
	IARC Group 2a Probable Carcinogens
	IARC Group 2b Possible Carcinogens
International: Canadian	Canadian Persistent, Bioaccumulative & inherently toxic chemicals
Other	Grandjean & Landrigan <i>The Lancet</i> , Neuro-developmental toxicants

*EPA's PBT list was considered but ultimately not used. CAS numbers were not available and the same PBTs were identified with CAS numbers in EPA's TRI program. See below for more information about CAS numbers.

Step 2: Screening potential exposure indicators

CSPA states (RCW 70.240.030) that the potential for exposure can be demonstrated if a chemical meets one or more of the following 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; or*

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

During this step, Ecology again cast a broad net in order to develop an inclusive list. We considered data published both by governments and in peer reviewed scientific literature.

Exposure data is less well developed than toxicity data, but authoritative government sources of information are available. These sources were identified using the same criteria used to identify the HPC list. Details for each data source are in the reference section. Table 2 shows the authoritative government sources for each criteria.

Table 2: Authoritative sources to identify exposure potential

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

If a chemical was found in any one of the four areas listed above, we included it, regardless of the number of samples tested or the level at which it was found. Assessment of the relevance of individual studies will be completed in Phase 3.

Ecology expanded upon the information in the above sources by including chemicals identified in studies published in three peer-reviewed scientific journals to which the agency had ready access:

- 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>

There are undoubtedly many other authoritative sources of information available, but resource and time constraints dictated that we begin our search on a small number of journals.

Keywords used in the journal search were:

Biomonitoring:

Adipose	Cord serum	Tissue
Biomonitoring	Placenta	Maternal blood
Blood	Human	Urine
Blood level	Human Exposure	Exposure
Breast milk	Infant	
Cord blood	Infant Exposure	

General:

Children	Child
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Indoor Air & Dust

Indoor Air	Dust	Indoor
House	Home	

Drinking water:

Drinking water	Public water
Water supply	Water

Products:

Consumer products	Toys
Product	Products

All papers identified during these searches were reviewed to determine if any of the exposure criteria were met. If so, chemicals from the study were placed on the list of exposure indicators. Once a chemical was placed on the list, no further work was done

to identify additional references. For example, there are numerous biomonitoring studies demonstrating the presence of chemicals such as PCBs or PBDEs in humans. Once identified through one biomonitoring study, we did not continue to search for further evidence of the chemical in people. However, if the same chemical was found in scientific studies covering other exposure pathways such as indoor air and dust, we documented that fact.

We also included chemicals that have been found in indigenous peoples of North America and Europe. Chemicals found in these populations are indicative of universal exposure since their exposure is most likely due to environmental sources rather than directly from the products themselves.

The references used to determine potential exposure can be found in the reference section (see References for Exposure and the Annotated References for Biomonitoring).

The following sources of information were excluded:

- Papers focusing on environmental but not human exposures.
- Papers describing exposures to people in countries without the same level of environmental regulation found in the United States such as China and India. Exposures described for these areas are not believed to be representative of what a child in Washington State would likely experience.
- Papers published before 1994. Analytical and epidemiological methods have become more standardized in recent years and we wanted to focus on currently used techniques.

Step 2 resulted in a list of 2,419 chemicals.

Identifying a Chemical Abstract Service number (CAS)

Because any chemical may have many different names, it will be difficult to comply with the law unless each chemical on the final reporting list has a unique identifier. Ecology used the Chemistry Abstract Services (CAS) number for this purpose. Only those chemicals having a CAS number will be included on the reporting list. CAS numbers are assigned by a division of the American Chemical Society, a large scientific society made up of scientists and engineers specializing in chemistry related endeavors. Theoretically each unique chemical is assigned a unique CAS number. Therefore although a chemical can assume many different names during common use, the underlying unique chemical can be defined by a single CAS number.

CAS numbers can be identified from a number of sources. If no CAS was provided by the authoritative sources (see Table 1), Ecology searched the Hazardous Substances Database (HSDB, part of ToxNet maintained by the National Library of Medicine). If no

CAS was available in the HSDB, we searched RTECS (the Registry of Toxic Effects of Chemical Substances) database, created by the National Institute of Occupational Health and Safety. These two databases provided CAS numbers for the vast majority of the chemicals identified. For those chemicals not found in either database Ecology conducted an internet search giving preference to sources such as government documents to identify an appropriate CAS number. Occasionally the CAS number was obtained from a business source.

Of the 2,146 chemicals identified as HPCs, 2,044 could be assigned a CAS number. Lists of HPCs with and without CAS numbers can be found in Appendices 1 and 2, respectively. Similarly, of the 2,419 chemicals identified as indicators of potential exposure, 2,219 had unique CAS numbers. CAS numbers could not be identified for 200 chemicals or chemical mixtures. The lists of exposure indicator chemicals with and without CAS numbers can be found in Appendices 3 and 4, respectively.

Step 3: Refining Potential CHCCs

Ecology identified 2,044 HPCs and 2,219 exposure indicator chemicals. As defined in the CSPA, those chemicals which are common to both groups, i.e. are **both** an HPC **and** found in exposure sources are Potential CHCCs. This process is captured in Figure 2 below.

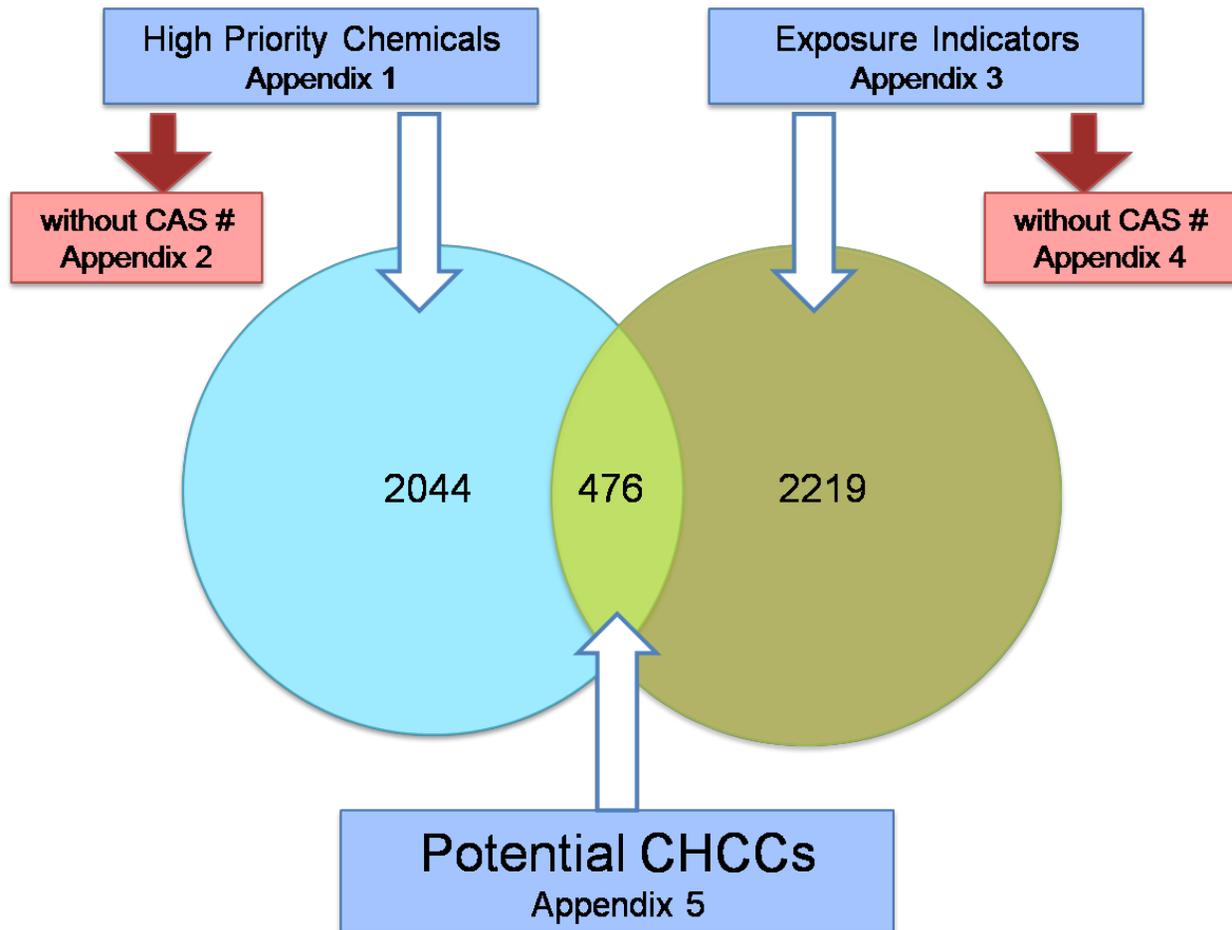


Figure 2 - Potential CHCCs

Based upon this process as of August 2009, Ecology identified 476 potential CHCCs which are found in Appendix 5.

While all 476 chemicals identified as potential CHCCs technically meet the criteria established by the CSPA, not all were carried forward for further assessment. Practical considerations led us to take steps to remove from consideration potential CHCCs currently addressed by overlapping regulatory frameworks, combustion byproducts, emerging chemicals, and chemicals with primarily ecological toxicity (See Figure 3).

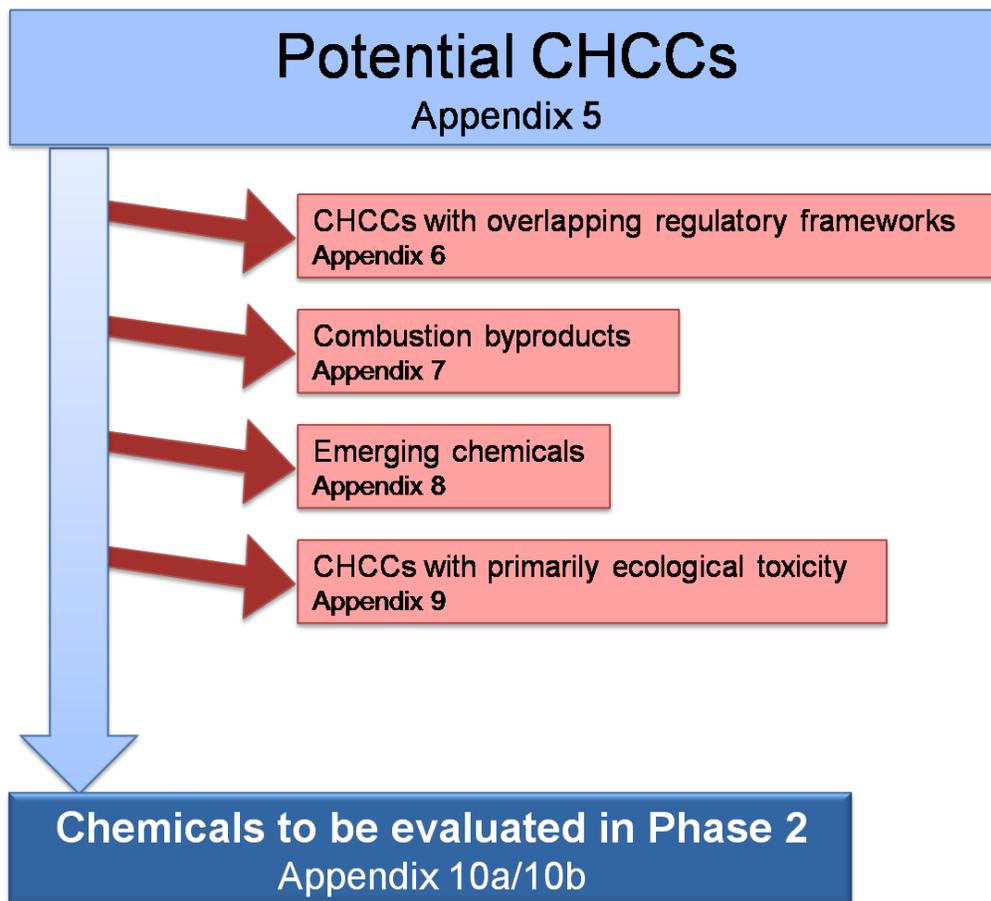


Figure 3 - Refining Potential CHCCs

Overlapping Regulatory Frameworks

Some potential CHCCs are extensively regulated at the Federal level. Others are already banned within Washington State or are regulated extensively by existing State law. In the interest of focusing the potential CHCC list, the following chemicals or chemical groups were removed from further consideration at this time:

- Federal Consumer Product Safety Improvement Act (CPSIA): In August 2008, the Federal Government passed the CPSIA, amending primarily the Consumer Products Safety Act as well as other consumer safety statutes. Based on existing regulation under CSPIA, we removed lead, cadmium, and phthalates.
- Banned chemicals: Some chemicals are banned from use within Washington State. Several polybrominated diphenyl ethers (PBDEs) are banned within Washington, but one form - decabrominated diphenyl ether (deca-BDE)- is only banned in certain applications and could still be used in children's products.

Therefore deca-BDE was retained while all other forms of PDBEs were removed from consideration at this time.

- Federal Toxic Substances Control Act (TSCA): TSCA authorizes the EPA to screen existing and new chemicals used in United States manufacturing and commerce in order to identify potentially dangerous products or uses that should be subject to federal control. Based on existing regulation under TSCA, we removed asbestos, dioxins and PCBs.
- Pesticides: Pesticides are regulated under federal and state law and, therefore, are considered lower priority at this time. However, there are several potential routes through which children can be exposed to pesticides, including use on products purchased for use by children or through exposures during use in the home. Therefore pesticides may warrant closer inspection during future updates of the Potential CHCC list.
- Other: Some chemicals are banned or controlled by other government agencies and were unlikely to be found in children's products. For example, several potential CHCCs are controlled by the U.S. Food and Drug Administration (nicotine, carbamazepine, amphetamines, methamphetamines and clofibrate), the U.S. EPA (carbon monoxide, thorium and radon) and the Controlled Substances Act (cocaine). These potential CHCCs were removed from consideration at this time.

All of the chemicals removed based on overlapping regulatory frameworks are found in Appendix 6.

Combustion Byproducts

Some potential CHCCs are primarily the result of combustion processes and are typically not intentionally added to children's products. For example, children may be exposed to a class of toxic chemicals called polyaromatic hydrocarbons (PAHs). The largest source of PAHs is from combustion of products such as gasoline and wood. Furans are the result of many types of combustion including fuels and wood. For the first list of CHCCs, Ecology is focusing on chemicals that are intentionally added to children's products. Combustion byproducts are an unfortunate consequence of manufacturing processes, but are not typically added to children's products. As a result, these potential CHCCs were removed from further consideration at this time.

A complete list of the specific PAHs and furans removed by this process is found in Appendix 7.

Emerging Chemicals

Some of the potential CHCCs identified in Phase 1 do not have strong evidence of toxicity. We want to focus on chemicals where the toxicity data is more compelling; therefore, we removed potential CHCCs where the evidence for human toxicity is suspected or possible. These potential CHCCs are identified as “emerging chemicals”.

Ecology separated the sources listed in Table 1 into primary and secondary sources. Primary sources are government sources which identify chemicals with known or probable toxicity. Secondary sources, identified in Table 3, include chemicals with less evidence of human toxicity. If a chemical was identified as a HPC based solely on secondary sources, it was not carried forward for further assessment. During future revisions of the CHCC list, emerging chemicals will be reevaluated.

Emerging chemicals are listed in Appendix 8.

Table 3: Secondary sources used to identify emerging chemicals.

Source
National Waste Min. Program Priority Chemicals
National Tox Program Carcinogens-Suspected
IRIS 1986 Category C (possible)
EU Endocrine Disruptors Cat 2
EU Chemicals identified for Risk Assessment
OSPAR Chemicals of Concern
IARC Group 2b Possible Carcinogens
VCCEP
Grandjean & Landrigan Neurotoxicants

Emphasis on Human Toxicity

As a final step, Ecology reviewed the remaining Potential CHCCs to verify that they possess human toxicity concerns. Some of the sources used to identify HPCs included both human and ecological toxicity concerns. For example, the Canadian Domestic Substance’s PB_iT (persistent, bioaccumulative and inherently toxic) list of chemicals includes chemicals with proven ecological toxicity but little or unknown human toxicity. Because the focus of the CSPA is on children and children’s products, we removed these potential CHCCs from consideration at this time.

Table 4 lists those sources of information that include ecological as well as human toxicity. If these sources did not identify specific human toxicity endpoints, the potential CHCCs in question were removed from the list. For this phase, no attempt was made to

quantify the level of human toxicity, only to verify that some level of human toxicity concern existed for these potential CHCCs. The potential CHCCs removed because of their primarily ecological toxicity concerns can be found in Appendix 9.

Table 4: Sources checked to eliminate potential CHCCs primarily listed for ecological toxicity

<u>HPC Sources that may include Ecological and Human Toxicity</u>
Canadian Persistent, Bioaccumulative, and Inherently toxic (PB _i T) chemicals
EPA TRI PBTs
EPA National Waste Minimization Program Priority Chemicals
EU PBTs
EU Chemicals selected for Risk Assessment
EU SVHC
OSPAR Chemicals of Concern
OSPAR Chemicals for Priority Action
WA PBT

Results of the Refining Process

Based upon decisions made during Step 3, the list of potential CHCCs was reduced from 476 to 177. These 177 chemicals are listed in Appendices 10A and 10B and were carried forward for further assessment in Phase 2. Appendix 10A identifies all of the sources which identified these potential CHCCs as HPCs. Appendix 10B identifies all of the sources used to identify exposure indicators. These two appendices summarize the information used to identify each Potential CHCC.

References for Hazards

HPCs Sources - United States Federal

Environmental Protection Agency

The U.S. Environmental Protection Agency (EPA) is the primary Federal Agency charged with protecting human health and the environment. As part of its mission, the EPA is responsible for enforcing a number of regulations and has established programs to work with businesses to address problems which impact their mission. Five EPA programs identify chemicals of concern appropriate for inclusion on the list of HPCs.

EPA PBT Program

EPA established a PBT program to reduce risks from, and exposures to, priority PBT chemicals. This program is intended to increase coordination among EPA national and regional programs with the aim of overcoming the remaining challenges in addressing these priority PBT pollutants.¹ As part of this effort, EPA identified 12 high priority PBTs which require immediate action.² EPA established a chemical profile fact sheet and will develop an action plan for each of these PBTs.

EPA Toxics Release Inventory (TRI) Program

EPA implements the Emergency Planning and Community Right to Know Act (EPCRA) which requires businesses and other organizations to report chemical releases to the environment. As part of this regulation, EPA maintains the TRI database which summarizes releases reported to EPA under this regulation.³ On October 29, 1999, EPA added reporting requirements for a list of Persistent, Bioaccumulative and Toxic (PBT) chemicals.⁴ As stated in the notice, these PBTs were identified because PBTs

‘...were found to be reasonably anticipated to cause serious or irreversible chronic human health effects or relatively low doses or ecotoxicity at relatively low concentrations, and thus are considered to have moderately high to high chronic toxicity or high ecotoxicity.’

In this process EPA identified four groups of chemicals such as dioxins and dioxin like compounds, mercury and lead compounds, and polycyclic aromatic hydrocarbons (PAHs) and 16 individual chemical species as PBTs. The Federal Register notice reported 64 specific Chemistry Abstract Services (CAS) numbers as PBTs.

Integrated Risk Information System

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. IRIS was initially developed for EPA staff in response to a growing demand for consistent information on substances for use in risk assessments,*

¹ More information on EPA’s PBT program can be found at: <http://www.epa.gov/pbt/index.htm>, accessed 11/18/2008

² More information on EPA’s Priority PBTs can be found at: <http://www.epa.gov/pbt/pubs/cheminfo.htm>, accessed 11/18/2008

³ More information on EPA’s EPCRA Program and TRI can be found at: http://www.epa.gov/triinter/triprogram/tri_program_fact_sheet.htm, accessed 11/18/2008

⁴ Federal Register notice at: <http://www.epa.gov/EPA-WASTE/1999/October/Day-29/f28169.htm>, accessed 11/17/2008

decision-making and regulatory activities. The information in IRIS is intended for those without extensive training in toxicology, but with some knowledge of health sciences.⁵

IRIS currently contains information on 548 chemicals or groups of chemicals and IRIS can be searched to determine chemicals of concern due to specific toxicity criteria. For example, the 548 chemicals can be searched to determine which are known, likely and probable human carcinogens based upon EPA screening criteria.⁶ 125 carcinogenic chemicals and 423 chemicals with primarily non-cancerous impacts were identified.

National Waste Minimization Program

EPA established the National Waste Minimization Program which supports efforts to promote a more sustainable society, reduce the amounts of waste generated, and lower the toxicity and persistence of wastes that are generated.⁷ The National Waste Minimization Program established a list of priority chemicals which consists of 28 ‘Organic Chemicals and Chemical Compounds’ and 3 ‘Metals and Metal Compounds’.⁸

Voluntary Children’s Chemical Exposure Program

In support of its mission, EPA established the Voluntary Children’s Chemical Exposure Program (VCCEP)⁹. VCCEP identified 23 chemicals which have a serious potential impact on the health of children. EPA has asked that manufacturers of these chemicals voluntarily provide information on their toxicity impacts to human health and specifically children’s health so the risks they pose can be quantified. The 23 chemicals identified in this process¹⁰ were included in the generation of the list of HPCs.

National Toxicology Program

The NTP is an interagency program managed by the U.S. 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 need for a program like the NTP arose because of increasing scientific, regulatory, and Congressional concerns about the human health effects of chemical agents in our environment.¹¹ The NTP has identified chemicals which pose a threat to human reproduction and which are known or suspected carcinogens.

NTP Center for the Evaluation of Risks to Human Reproduction

⁵ More information on EPA’s IRIS can be found at: <http://cfpub.epa.gov/ncea/iris/index.cfm>, accessed 11/18/2008

⁶ The search criteria and chemicals can be found on the IRIS site at: http://www.epa.gov/ncea/iris/search_human.htm, accessed 11/18/2008

⁷ More information on EPA’s Waste Minimization Program can be found at: <http://www.epa.gov/osw/hazard/wastemin/index.htm>, accessed 11/18/2008

⁸ More information on these chemicals can be found at: <http://www.epa.gov/osw/hazard/wastemin/priority.htm>, accessed 11/18/2008

⁹ Information on VCCEP can be found at: <http://www.epa.gov/oppt/vccep/index.htm>, accessed 11/17/2008.

¹⁰ VCCEP chemicals are identified at: <http://www.epa.gov/oppt/vccep/pubs/basic.htm#basic3>, accessed 11/17/2008

¹¹ More information on the NTP and its work can be found at: <http://ntp.niehs.nih.gov/?objectid=720163C9-BDB7-CEBA-FE4B970B9E72BF54>, accessed 11/18/2008

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 (collectively referred to as “substances”) cause adverse effects on reproduction and development and provide opinion on whether these substances are hazardous for humans.¹² Through this process, the CEHR has identified 40 chemicals of concern¹³.

NTP Report on Carcinogens

The NTP also 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.¹⁴ The RoC includes two categories of carcinogenic compounds:

1. Chemicals ‘known to be human carcinogens’.
2. Chemicals ‘reasonably anticipated to be human carcinogens’

The 11th RoC report identifies 56 Category A and 185 Category B carcinogens.

HPCs SOURCES –U.S. STATES

California’s Proposition 65 Program

Proposition 65 (Prop 65), the Safe Drinking Water and Toxic Enforcement Act of 1986, was enacted as a California ballot initiative in November 1986. Prop 65 was intended by its authors to protect California citizens and the State’s drinking water sources from chemical chemicals known to cause cancer, birth defects or other reproductive harm, and to inform citizens about exposures to such chemicals.¹⁵

Each year, the Office of Environment Health Hazard Assessment section of the California EPA publishes an updated list of chemicals of concern. The list currently contains more than 700 unique chemicals that exhibit carcinogenic and/or reproductive toxicity.¹⁶

WA State PBT Program

In 2006, Ecology adopted regulations specific to PBTs (WAC 173-333). 27 PBTs are identified including 25 organic chemicals or chemical groups and two metals of concern. Washington’s list includes 75 unique chemicals with individual CAS numbers.

¹² NTP CERHR found at: <http://cerhr.niehs.nih.gov/aboutCERHR/index.html>, accessed 11/17/2008

¹³ Information on the CEHR list can be found at: <http://cerhr.niehs.nih.gov/chemicals/index.html>, access 11/18/2008

¹⁴ NTP RoC found at: <http://ntp.niehs.nih.gov/?objectid=72016262-BDB7-CEBA-FA60E922B18C2540>, accessed 11/17/2008

¹⁵ More information on Prop 65 can be found at: <http://www.oehha.org/prop65.html>, accessed 11/17/2008

¹⁶ The Prop 65 List can be found at: http://www.oehha.org/prop65/prop65_list/files/P65single091208.pdf, access 11/18/2008

HPCs Sources - International

International Agency for Research of Cancer

The International Agency for Research on Cancer (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.¹⁷ In addition, IARC publishes monographs which identify carcinogenic chemicals and separates them into four main groups:¹⁸

- Group 1: *Carcinogenic to humans.* (47 chemicals/chemical groups out of 105)
- Group 2A: *Probably carcinogenic to humans.* (51 chemicals/chemical groups out of 66)
- Group 2B: *Possibly carcinogenic to humans.* (221 chemicals/chemical groups out of 248)
- Group 3: *Not classifiable as to its carcinogenicity to humans.* (515 chemicals)
- Group 4: *Probably not carcinogenic to humans.* (1 chemical)

The chemicals in Groups 1 and 2 (both 2A and 2B) identified above were added to the HPC list.

European Union (EU) Substances of Very High Concern (SVHC) Program

The European Chemicals Agency (ECHA) prepares Annex XV dossiers for the identification of substances of very high concern which are carcinogenic, mutagenic or reproductive toxins (CMRs), PBTs or cause serious effects to human health or the environment of an equivalent level of concern as those above (e.g. endocrine disrupters).¹⁹ ECHA has only begun the process of identifying SVHCs and currently lists 16 on its website.

European Commission

The mission of the European Commission (EC) is to promote the general interest of the European Union. It presents proposals for European law, oversees implementation of Treaties and European law and carries out common policies and managing funds.²⁰ The EC conducts work on a wide range of environmental issues and has established several databases which address chemical specific issues undertaken by the EC to address chemical safety.

Endocrine Disruptor Program

On 20 December 1999, the European Commission adopted a Communication on a Community Strategy for Endocrine Disrupters – a range of substances suspected of interfering with the hormone systems of humans and wildlife. The strategy focuses on

¹⁷ More information on IARC can be found at: <http://www.iarc.fr/>, accessed 11/17/2008

¹⁸ IARC Monographs found at: <http://monographs.iarc.fr/ENG/Classification/Listagentsalphorder.pdf>, accessed 11/17/2008

¹⁹ More information on SVHCs can be found at:

http://echa.europa.eu/consultations/authorisation/svhc/svhc_cons_en.asp, accessed 11/17/2008

²⁰ Governing Statement of the European Commission at:

http://ec.europa.eu/atwork/synthesis/doc/governance_statement_en.pdf, accessed 11/20/2008

man-made substances, including chemicals and synthetic hormones, which may harm health and cause cancer, behavioral changes and reproductive abnormalities.²¹

Endocrine disruptors were grouped into four major categories:

Category 1: Evidence of endocrine disruption activity (194 chemicals)

Category 2: Some evidence of biological activity related to endocrine disruption (125 chemicals)

Category 3: No scientific evidence of endocrine disrupting activity

3A: No data available on wildlife relevant and/or mammal relevant endocrine effects (23 chemicals)

3B: Some data available but evidence is insufficient for identification (85 chemicals)

3C: Data available indicating no scientific basis for inclusion in list (0 chemicals- details not provided)

The EC also provides an Access database which contains all of the chemicals reviewed and enables one to separate out the chemicals into the categories identified above²². For the purposes of the Children's Safe Product Act, only Categories 1 and 2 were considered.

PBT Program

In June 2001, the EC initiated an interim strategy to identify and address PBT chemicals. The results of this work can be found in the internet databases, ESIS (European chemical Substances Information System) which identifies PBT (Persistent, Bioaccumulative, and Toxic) or vPvB (very Persistent and very Bioaccumulative) chemicals.²³ 127 potential PBT chemicals are listed in ESIS. Of these 127, 66 are identified as 'Not fulfilling PBT & vPvB criteria' and were eliminated from further consideration.

Chemicals identified for Risk Assessment

The EC also maintains a website providing information to address the Existing Substances Regulation (ESR), which required a comprehensive framework for the evaluation and control of "existing substances". The ESR states that the EC, in consultation with Member States, will regularly draw up sources of priority substances which require immediate attention because of their potential effects to man or the environment.²⁴ 141 Compounds have been identified since this regulation passed in 1994.

Oslo-Paris Convention (OSPAR)

The OSPAR Commission, originally formed in 1972 to control dumping into the North Sea, is a consortium of 15 European Countries and the European Community whose mission is to protect

²¹ More information on the EU Endocrine disruptors program can be found at:

http://ec.europa.eu/environment/endocrine/documents/sec_2007_1635_en.htm, accessed 11/17/2008

²² The database containing these endocrine disruptors can be found at:

http://ec.europa.eu/environment/endocrine/strategy/substances_en.htm#priority_list, accessed 11/18,2008

²³ More information on EC PBTs can be found at: <http://ecb.jrc.ec.europa.eu/esis/index.php?PGM=pbt>, accessed 11/17/2008

²⁴ More information on ORATS can be found at: <http://ecb.jrc.ec.europa.eu/esis/index.php?PGM=ora>, accessed 11/18/2008

the marine environment of the North-East Atlantic. OSPAR has expanded over the years to include land based and production sources of potential pollution to the North-East Atlantic. The 1992 OSPAR Convention is the current instrument guiding international cooperation to meet these objectives.²⁵

OSPAR identified chemicals of concern to the North-East Atlantic. The first of these is a list of 310 chemicals or chemical groups of possible concern which consists mainly of PBT chemicals with a few endocrine disruptors included.²⁶ OSPAR further identified a shorter list of 50 chemicals or chemical groups which require priority action.²⁷

Canadian Environmental Protection Act

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.²⁸ 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.²⁹

For the purposes of the Children's Safe Product Act, only PBiT (persistent, bioaccumulative and inherently toxic) chemicals were considered for the HPC list.

HPCs Sources - Other

Grandjean & Landrigan Identification of Neurodevelopmental Toxicants

Two well known toxicological researchers conducted a detailed evaluation of potential neurodevelopmental toxicants.³⁰ Their identification of 201 industrial chemicals that have caused neurotoxic effects in man was based upon data from the Hazardous Substances Database of the U.S. National Library of Medicine, supplemented by fact sheets by the U.S. Agency for Toxic Substances and Disease Registry, and the Integrated Risk Information System (IRIS) of the U.S. EPA.

²⁵ More information on OSPAR can be found at:

http://www.ospar.org/content/content.asp?menu=00010100000000_000000_000000, accessed 11/18/2008

²⁶ More information on the OSPAR Chemicals of Possible Concern can be found at:

http://www.ospar.org/content/content.asp?menu=00950304450000_000000_000000, accessed 11/18/2008

²⁷ More information on OSPAR Chemicals for Priority Action can be found at:

http://www.ospar.org/content/content.asp?menu=00940304440000_000000_000000, accessed 11/18/2008

²⁸ For more information on CEPA see: http://www.ec.gc.ca/CEPARRegistry/gene_info/, accessed 11/18/2008

²⁹ CEPA found at: http://www.ec.gc.ca/CEPARRegistry/subs_list/dsl/dslsearch.cfm, accessed 11/17/2008

³⁰ The Lancet at: [http://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(06\)69665-7/fulltext#](http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(06)69665-7/fulltext#), accessed 12/8/2011

References for Exposure

Biomonitoring Data

The following two government sponsored studies on chemicals found in people were identified. These large scale studies provide information on chemicals which are found in human tissue, blood, and urine:

- The Center for Disease Control and Prevention (CDC) National Health and Nutrition Examination Study (NHANES)
- The Danish Birth Cohort

In 2005-2006, CDC interviewed approximately 7,000 U.S. residents and collected blood and urine samples from approximately 5,000 people.³¹ The study is statistically controlled to distribute samples across all age and race groups which approximate the population distribution in the U.S. The CDC publishes many of its results in a yearly report and individual monographs of new analytical results as they come available. The NHANES study cited here is the *Third National Report on Human Exposure to Environmental Chemicals*³² which includes data from 1999 to 2003 including data in the First and Second National Reports and articles published since the Third National Report was issued in 2005³³.

The Danish Birth Cohort is a program initiated in the Nordic Countries to determine the impact of numerous external stimuli upon the development of children. Between 1997 and 2000, mother and child pairs were recruited into a long-term study to evaluate the impacts of early exposures upon long-term development. The aim was to recruit at least 100,000 pairs and as of 2000, 60,000 had been recruited.³⁴ A component of this research included obtaining blood samples from both mother and child and to have repeated contact every seven years as the child develops. Information from this study is just becoming available.³⁵ This study, while not specific to the American population, is still considered an appropriate source of information since the economies of Europe and the U.S are similar and therefore exposures are also likely to be similar.

In addition to these reports, studies published in peer reviewed, scientific journals were identified. These references do not represent an exhaustive compilation of the research conducted in these areas but are more of a snapshot of the types of studies that identify the characteristics of chemicals found in human tissue. The intent is to build the list of chemicals of high concern for children based on credible scientific studies. Ecology has identified the following publications as important for this effort. This list will be revised as new studies are published and more studies are reviewed.

³¹ CDC report at: http://www.cdc.gov/nchs/data/nhanes/nhanes_05_06/general_data_release_doc_05_06.pdf, accessed 11/20/2008

³² Report available at: <http://www.cdc.gov/exposurereport/pdf/thirdreport.pdf>, accessed 11/20/2008

³³ More recent monitoring results available at: <http://www.cdc.gov/exposurereport/>, accessed 11/20/2008

³⁴ From Olsen et al., *The Danish National Birth Cohort-its background, structure and aim*, Scan. J. Public Health 2001, 29, 300-307, available at: <http://www.ssi.dk/graphics/html/bsmb/danishbirthcohort.pdf>, accessed 11/20/2008

³⁵ More information on the Danish National Birth Cohort is available at: <http://www.ssi.dk/sw9314.asp>, access 11/20/2008

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Indoor Air and Dust Data

Authoritative sources of information on chemicals found in indoor air and dust include:

- California Air Resources Board (CARB)
- German Environmental Survey (GerES)

The California Air Resources Board (CARB) is a part of the California Environmental Protection Agency and is the agency responsible for evaluating and protecting air quality for the residents of the state. CARB conducted research into a number of air pollution areas including indoor air in a report to the California Legislature in 2005.³⁶ The German Environmental Survey (GerES) is a nation-wide survey conducted to evaluate the exposure of the population to environmental contaminants. At least 5,000 people throughout Germany are included in the GerES³⁷ and chemicals in indoor air are one component of the survey.

In addition, the following publications were identified as sources of information about chemicals found in indoor air and dust. As indicated earlier, the references identified to date do not represent an exhaustive compilation of the research conducted in this area.

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Drinking Water Data

The U.S. EPA Drinking Water Program identified contaminants of concern in drinking water and established regulations to limit the concentrations of these chemicals.

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Consumer Product Data

As there are few sources for chemicals in U.S. products, the majority of our references on chemicals used in consumer products are from Danish and Dutch government studies. The Danish Ministry of the Environment (Danish EPA) conducted studies on chemicals used in consumer products³⁸, many of which have been translated into English. For many of these studies, the Danish EPA went into the marketplace, purchased consumer products of interest and analyzed the products for chemicals of concern. They also conducted off-gassing or leaching studies on many of the products and included these results in their reports. These reports are the best source of information on chemicals in products the agencies have been able to identify.

³⁸ More information on the Danish EPA program and related publications is available at:
http://www.mst.dk/English/Chemicals/Danish_initiatives/, accessed 11/20/2008

To date, Ecology has identified 40 studies which document the presence of toxic chemicals in products including 18 which have focused specifically on products sold to or used by children.

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Annotated References for Biomonitoring

Primary Sources:

CDC NHANES Results:

Reference:	(Blount 400-07)
Chemicals:	Perchlorate
Sample size:	2,820
Population type:	NHANES 2001-02
Selection process:	Complex, stratified, multistage, probability-cluster design
Detected in:	Urine
Results:	<i>'We found detectable levels of perchlorate... in all 2820 urine samples tested.'</i>

Reference:	(Blount 1865-71)
Chemicals:	Perchlorate
Sample size:	2,229
Population type:	NHANES results
Selection process:	Complex multistage probability sampling designed to be representative of the US population.
Detected in:	Urine
	Serum
Results:	<i>'Perchlorate was not a significant predictor of T4 or TSH levels in men. For women overall, perchlorate was a significant predictor of both T4 and TSH.'</i>

Reference:	(Calafat 893-97)
Chemicals:	Benzophenone-3
Sample size:	2,517
Population type:	NHANES 2003-04
Selection process:	Complex, stratified, multistage, probability-cluster design
Detected in:	Urine
	<i>'Exposure to BP-3 was prevalent in the general U.S. population during 2003-2004.... We detected BP-3 in 96.8% of the samples.'</i>

Reference:	(Calafat 1596-602)
Chemicals:	Perfluorinated compounds
Sample size:	2,094 participants ≥ 12 years of age
Population type:	NHANES 2003-04
Selection process:	Complex, stratified, multistage, probability-cluster design
Detected in:	Serum

Results:	<i>'Four analytes were detected in >98% of the samples (PFOS, PFOA, PFHxS, PFNA)...Six other analytes were detected at lower frequencies (PFDeA, Me-PFOSA-AC-OH, PFOSA, FPUA, PFHpA, Et-PFOSA-Ac-O)... Two analytes were detected in <0.1% of the samples (PFDoA, PFBuS).'</i>
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Reference:	(Calafat 303-07)
Chemicals:	Triclosan (2,4,4'-trichloro-2'-hydroxydiphenyl ether)
Sample size:	2,517
Population type:	NHANES
Selection process:	1/3 random subset of NHANES participants
Detected in:	Urine
Results:	<i>'We detected concentrations of total... triclosan in 74.6% of samples at concentrations of 2.4-3,790 µg/L.'</i>

Reference:	(Calafat 39-44)
Chemicals:	Bisphenol A, etc.
Sample size:	2,517
Population type:	NHANES
Selection process:	1/3 random subset of NHANES participants
Detected in:	Urine
Results:	<i>'We measured the total... urinary concentrations of BPA and tOP in 2,517 participants ≥ 6 years of age....'</i>

Reference:	(Caldwell 1-10)
Chemicals:	Arsenic compounds
Sample size:	9,643
Population type:	NHANES
Selection process:	1/3 random subset of NHANES participants using complex multistage probability sample design
Detected in:	Urine
Results:	Several arsenic compounds found in urine samples from 2,557 participants ranging from 0.3 to 35% of the individuals.

Reference:	(Centers for Disease Control)
Chemicals:	Minimum 187 up to ~320
Sample size:	9,282 volunteers
Population type:	Representative sample of the civilian, non-institutionalized population in the US
Selection process:	Complex, stratified, multistage, probability-cluster design
Detected in:	Urine

	Serum
Results:	<i>'Arsenic acid, arsenous acid, arsenocholine, and trimethylarsine oxide were detected in 7.6%, 4.6%, 1.8% and 0.3% of the participants... Monomethylarsonic acid was detected in 35%... dimethylarsinic acid... and arsenobetaine... had the greatest contribution to the total urinary arsenic levels.'</i>

Reference:	(Sjodin)
Chemicals:	PBDEs
Sample size:	2,062
Population type:	All participants in NHANES study above age of 12
Selection process:	Complex, stratified, multistage, probability-cluster design
Detected in:	Serum
Results:	Table 1: PBDEs and BB-153 were found in between 5 and 93% of the samples.

Reference:	(Valentin-Blasini 509-23)
Chemicals:	Pesticides
Sample size:	3,094
Population type:	1/3 of the NHANES study
Selection process:	Random selected from NHANES
Detected in:	Urine
Results:	<i>'We measured the isoflavones... in approximately 2,500 urine samples from individuals aged 6 years and older... We detected all phytoestrogens in over 70% of the samples analyzed.'</i>

Danish Birth Cohort:

Reference:	(Fei et al. 1677-82)
Chemicals:	Perfluorinated compounds
Sample size:	1,400
Population type:	Mothers and newborns
Selection process:	Randomly selected from 43,045 women in the Danish National Birth Cohort
Detected in:	Blood
Results:	<i>'Maternal PFOA levels in early pregnancy were associated with small abdominal circumference & birth length... An inverse association was also observed between PFOA and placental weight... Maternal PFOS levels were not associated with any of the five fetal growth indicators..'</i>

Additional Scientific Studies:

Reference:	(Acquavella et al. 321-26)
Chemicals:	Glyphosate
Sample size:	127
Population type:	Farmers (48) and their children (79)
Selection process:	Recruited from a random selection process
Detected in:	Urine
Results:	<i>'For children, 12% had detectable levels of glyphosate in their urine...'</i>

Reference:	(Alvarez-Pedrerol 955-62)
Chemicals:	PCBs, DDT & related compounds
Sample size:	259
Population type:	General population birth cohort
Selection process:	All children from 0 to 4 in the cohort; From all 468 (97.1% of total) children born between July 1997 and December 1998, 259 had measurable organochlorines at age 4 and were included in this analysis.
Detected in:	Blood
Results:	<i>'Blood levels of p,p'-DDT, β-HCH, PCBs were related to lower total T3 levels. In addition, free T4 was inversely associated with PCB-118.... This study suggests that even at background levels of exposure, OC [organochlorines] may affect thyroid system...'</i>

Reference:	(Apelberg et al. 1670-76)
Chemicals:	Perfluorinated compounds
Sample size:	293
Population type:	Hospital-based cross-sectional epidemiologic study of singleton deliveries
Selection process:	Anonymous selection from all births which fit criteria and for which sufficient sample was available
Detected in:	Cord blood
Results:	<i>'Despite relative low cord serum concentrations, we observed small negative associates between both PFOs & PFOA concentrations and birth weight and size.'</i>

Reference:	(Barr et al. 1474-78)
Chemicals:	Atrazine
Sample size:	24
Population type:	Cross section of exposure types with high (n=8), low (n=5) and environmental (n=11) exposure to atrazine
Selection process:	Anonymous selection from all births which fit criteria and for which sufficient sample was available
Detected in:	Volunteers
Results:	<i>'We found that the urinary metabolite profiles varied greatly among exposure scenarios and among persons within each exposure scenario.... We have likely been underestimating population-based</i>

	<i>exposures by measuring only one urinary ATZ metabolite.'</i>
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Reference:	(Bjornberg 1381-85)
Chemicals:	Mercury
Sample size:	20
Population type:	Breast feeding mothers
Selection process:	Volunteers via recruitment. No particular exclusions were made.
Detected in:	Breast milk
	Infant blood
	Maternal blood
Results:	<i>'Infant blood MeHg was highly associated with maternal blood MeHg at deliver, although more than twice as high.... Infant blood I-Hg was associated with, and about as high as, maternal blood I-Hg at delivery.'</i>

Reference:	(Blount 1-6)
Chemicals:	Perchlorate
Sample size:	27
Population type:	Men and women living in the Atlanta, GA area
Selection process:	Non-representative convenience population
Detected in:	Urine
Results:	<i>'Consumption of...foods [high in perchlorate] ... was associated with significantly higher levels of perchlorate in urine...compared with study participants consuming one or fewer servings of these foods...'</i>

Reference:	(Braverman 2721-24)
Chemicals:	Perchlorate
Sample size:	94 original subjects, 24 randomized with 14 completing study
Population type:	Volunteers
Selection process:	Prospective, double-blinded, randomized trial
Detected in:	Urine
Results:	<i>'We observed that a 6-month exposure to perchlorate at does up to 3 mg/d had no effect on thyroid function...'</i>

Reference:	(Cohn 1406-14)
Chemicals:	DDT and related compounds
Sample size:	258
Population type:	Prospective, nested case-control study with a median time to diagnosis of 17 years using blood samples obtained from young women from 1959-1967
Selection process:	Volunteers
Detected in:	Blood

Results:	<i>'High levels of serum p,p'-DDT predicted a statistically significant five-fold increased risk of breast cancer among women who were born after 1931.'</i>
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Reference:	Curl 2002
Chemicals:	Pesticides
Sample size:	213 (farmers), 211 (Children), 156 (house dust)
Population type:	Farmers, children and house dust
Selection process:	Recruited subjects
Detected in:	Urine
Results:	<i>'The results of this work support the hypothesis that the take-home exposure pathway contributes to residential pesticide contamination in agricultural homes where young children are present.'</i>

Reference:	(Dallaire et al. 1660-64)
Chemicals:	PCBs, DDT & related compounds, lead, mercury, chlorinated pesticides
Sample size:	138
Population type:	Pregnant Inuit women
Selection process:	Volunteers
Detected in:	Umbilical cord blood
Results:	<i>'...we found strongly significant decreasing trends for PCBs...DDT ... and HCB. No significant trends were detected for chlordanes. A significant reduction of lead and mercury concentrations was found but there was no clear linear or exponential trend.'</i>

Reference:	(Damgaard 1133-38)
Chemicals:	Chlorinated pesticides
Sample size:	62 health boys and 68 with cryptorchidism
Population type:	Longitudinal birth cohort study
Selection process:	Volunteer
Detected in:	Breast milk
Results:	<i>'Eight organochlorine pesticides were measurable in all samples... Five compounds were measurable in most samples but in lower concentrations.. ... Seventeen of 21 organochlorine pesticides were measure in higher median concentrations in case milk than in control milk.'</i>

Reference:	(Gomara 6961-68)
Chemicals:	PBDEs
Sample size:	113 maternal serum samples, 104 paternal serums, 92 umbilical cord serums, 30 placentas and 52 breast milk samples
Population type:	Individuals living in the city of Madrid

Selection process:	Volunteers
Detected in:	Umbilical cord serum
	Paternal serum
	Maternal serum
	Placenta
	Breast milk
Results:	<i>'The results show that PBDEs, like other POPs, can cross the placenta barrier... The presence of PBDEs in cord blood and placenta samples indicates that there is prenatal exposure of PBDEs, which could continue after birth via breast milk.'</i>

Reference:	(Kim 1662-67)
Chemicals:	Solvents
Sample size:	8
Population type:	Lactating women
Selection process:	Volunteers
Detected in:	Breast milk
Results:	<i>'...we observed median VOC concentrations in Baltimore human milk of 0.09, 0.55, 0.12, and 0.46 ng/mL for MTBE, chloroform, benzene and toluene, respectively.'</i>

Reference:	(Main 1519-26)
Chemicals:	PBDEs
Sample size:	86 placenta-milk pairs
Population type:	Males with and without cryptorchidism (95 with and 185 without)
Selection process:	Only samples in larger study for which there were samples for placenta and milk from the same individual
Detected in:	Placenta
	Breast milk
Results:	<i>'... placenta PBDEs concentrations in fat were lower than in breast milk and a larger portion of congeners were non-detectable...The concentration of PBDEs in breast milk was significantly higher in boys with cryptorchidism than controls...'</i>

Reference:	(Main 270-76)
Chemicals:	Phthalates
Sample size:	130
Population type:	65 boys with cryptorchidism and 65 controls
Selection process:	Controls selected randomly in Denmark; boys from Finland were selected by a case-control design selecting boys with cryptorchidism with matched controls; Recruitment, inclusion criteria & clinical examination explained in Boisen et al. 2004.
Detected in:	Breast milk

Results:	<i>'All phthalate monoesters were found in breast milk with large variations... Our data Suggest that human Leydig cell development and function may also be vulnerable to prenatal exposure to some phthalates. Our findings are also in line with other data showing incomplete virilization in infant boys exposed to phthalates prenatally.'</i>
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Reference:	(McGlynn 663-71)
	Chlorinated pesticides
Sample size:	754 case subjects and 928 control subjects
Population type:	Servicemen enrolled in a Testicular Tumor Environmental and Endocrine Determinants Study
Selection process:	Volunteer
Detected in:	Serum
Results:	<i>'Increased exposure to p,p'-DDE may be associated with the risk of both seminomatous and non-seminomatous TGCTs [testicular germ cell tumors], whereas exposure to chlordane compounds and metabolites may be associated with the risk of seminoma.'</i>

Reference:	(Muckle 1291-99)
Chemicals:	PCBs, chlorinated pesticides, mercury, lead, selenium
Sample size:	98-159 (varies depending upon target chemical)
Population type:	Pregnant women, both before & after birth, offspring of these women
Selection process:	Volunteers from all pregnant women, Nov. 1995-Mar. 2001
Detected in:	Cord plasma
	Maternal plasma
	Maternal hair
	Maternal milk
Results:	<i>'Cord blood, maternal blood, and maternal hair mercury concentrations averaged 18.5 µg/l, 10.4 µg/l and 3.7 µg/g, respectively... Concentrations of PCB congener 153 averaged 86.9, 105.3 and 131.6 µg/kg (lipids) in cord plasma, maternal plasma, and maternal milk, respectively.... Levels of ... selenium in blood are relatively high.'</i>

Reference:	(Naert)
Chemicals:	PCBs
Sample size:	53
Population type:	31 men and 22 women, 19-84 years old, average age 53
Selection process:	Obtained at death (autopsy)
Detected in:	Adipose tissue
Results:	<i>'...Concentrations of PBDEs in 53 adipose tissue samples from the Belgian population were comparable to previously reported data in Europe ... but were considerably lower than PBDE concentrations in human adipose tissue samples from California...'</i>

Reference:	(Pearce 1673-77)
Chemicals:	Perchlorate
Sample size:	57
Population type:	Lactating women living in the Boston area
Selection process:	Volunteers
Detected in:	Breast milk
	Urine
	Food (infant formula)
Results:	<i>'Perchlorate was detectable in all 49 breast milk samples... all 56 urine samples...and all 17 infant formula samples... measured.'</i>

Reference:	(Peters)
Chemicals:	Phthalates, synthetic musks, various additives to consumer products, chlorinated pesticides, fluorinated compounds
Sample size:	42 maternal blood serum and 27 cord blood serum samples
Population type:	Mother and child pairs in the Netherlands
Selection process:	Volunteers
Detected in:	Maternal blood serum
	Cord blood
Results:	<i>'...the results clearly indicate the presence of this broad suite of man-made chemicals in human blood. ...the results show that exposure of the mother inevitable leads to the exposure of the unborn child.'</i>

Reference:	(Reiner 3815-20)
Chemicals:	Synthetic musks and other consumer product additives
Sample size:	39
Population type:	Women
Selection process:	Volunteer
Detected in:	Breast milk
Results:	<i>'Synthetic musks were found in most of the samples analyzed, and the concentrations ranged from <2 to 150 ng musk xylene/g, <2 to 238 ng musk ketone/g, <5 to 917 ng HHCB/g, <5 to 144 ng AHTN/g....'</i>

Reference:	(Ribas-Fito 1-8)
Chemicals:	DDT and metabolite
Sample size:	475
Population type:	Two birth cohorts from 1997-1999 in Spain
Selection process:	All children born in the selected areas between the dates identified
Detected in:	Cord serum levels
Results:	<i>'Results showed that DDT cord serum concentration at birth was</i>

	<i>inversely associated with verbal, memory, quantitative, and perceptual-performance skills at age 4 years.'</i>
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Reference:	(Ribas-Fito)
Chemicals:	Hexachlorobenzene (HCB)
Sample size:	475
Population type:	Two birth cohorts from 1997-1999 in Spain
Selection process:	All children born in the selected areas between the dates identified
Detected in:	Cord serum
Results:	<i>'Prenatal exposure [of HCB]... is associated with a decrease in the behavioral competence at preschooler ages.'</i>

Reference:	(Schreiber 655-64)
Chemicals:	Tetrachloroethylene
Sample size:	17 test subjects & 17 controls 9 test subjects and 9 controls
Population type:	6 families above dry cleaners and day care workers above dry cleaning facility
Selection process:	Volunteers
Detected in:	Air
	Blood
	Urine
	Breath
Results:	<i>'...perc levels in breath, blood and urine were 1-2 orders of magnitude in excess of background values.... Group-mean visual contrast sensitivity...was significantly reduced in the 17 exposed study participants relative to unexposed matched-control participants.'</i>

Reference:	(Thomsen 1414-18)
Chemicals:	PBDEs & other brominated compounds
Sample size:	Ranges from 10 for some of the specific age groups to 34 for specific years
Population type:	Males from the ages of 0 to > 60 years
Selection process:	Pooled samples from a serum specimen bank maintained by the Norwegian National Institute of Public Health
Detected in:	Serum
Results:	<i>'The serum concentrations of all BFRs increased during the entire period with the exception of TriBP and the sum of the 6 PBDEs increased from 0.44 ng/g lipids in 1977 to 3.3 ng/g lipids in 1999.'</i>

Reference:	(Whyatt et al. 749-56)

Chemicals:	Pesticides
Sample size:	460
Population type:	Mother and new born pairs (230 each)
Selection process:	Prospective cohort study of minority mothers and their newborns using recruited women
Detected in:	Maternal blood
	Umbilical cord blood
Results:	<i>'...seven pesticides were detected in 48-53% of plasma samples... The remaining 22 pesticides were detected in 0-45% of air or plasma samples.... Findings indicate that pesticide exposures are frequent but decreasing and that the pesticides are readily transferred to the developing fetus during pregnancy.'</i>

Reference:	(Wolf)
Chemicals:	Phthalates, various chlorinated phenols and other consumer product additives
Sample size:	90
Population type:	Girls
Selection process:	Randomly selected volunteers in a pilot study
Detected in:	Urine
Results:	<i>'The majority of analytes were detected in more than 94% of samples.'</i>

Reference:	(Ye et al. 1843-46)
Chemicals:	Preservatives used in consumer products
Sample size:	100 anonymous adults
Population type:	Demographically diverse group
Selection process:	
Detected in:	Urine
Results:	<i>'We detected methyl and n-propyl parabens at the highest mean concentrations.... In near all... of the samples. We also detected other parabens in more than half of the samples....'</i>

Reference:	(Zachara 1043-46)
Chemicals:	Selenium
Sample size:	905
Population type:	Lactating women between 17 and 75 days of lactation
Selection process:	Not stated
Detected in:	Breast milk
Results:	<i>The calculated daily Se intakes by breast-fed infants varied from 6.46 to 8.5 ug/day... This amount does not meet the recommended dietary allowance for infants between 0 and 6 months of age.'</i>

Reference:	(Zalko 674-77)
Chemicals:	PBDEs & TBBPA
Sample size:	93 (49 additional samples for method development)
Population type:	Mother/newborn pairs
Selection process:	142 pregnant women hospitalized for caesarean deliveries from April 2003 to September 2006
Detected in:	Maternal cord serum
	Cord serum
	Maternal adipose tissue
	Breast milk
Results:	<i>'Our results clearly demonstrate... deca-BDE as well as other PBDE of high molecular weight (mainly octa and nona-BDE) account for a large part of the PBDE present in adipose tissue, mother's milk, maternal and umbilical cord serum, which is fully consistent with in vivo experiments carried out in pregnant rats.'</i>