



# Additional information for health care professionals and relay partners

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This document was developed within the framework of the first edition of the National Action Plan on Endocrine Disruptors (NAPED), action sheet A.2, and the third edition of the National Environment-Health Action Plan (NEHAP3). Its objective is to help you respond to requests that you may receive from your patients or the general public, as part of awareness campaigns on endocrine disruptors carried out among the general public by the competent Belgian authorities.

The following questions are treated in this document :

- What do we mean by 'endocrine disruptors'?
- What are the potential sources and routes of exposure to endocrine disruptors?
- What populations are most vulnerable and what are the critical periods of exposure?
- What are the health effects of endocrine disruptors?
- How can exposure to endocrine disruptors be reduced?

You can find sources and links to additional information at the end of the document.

## What do we mean by 'endocrine disruptors'?

According to the definition of the World Health Organization, **“an endocrine disruptor is an exogenous substance or mixture altering the functions of the endocrine system and thereby inducing harmful effects on the health of an intact organism, its descendants or within (sub)populations”**.

Endocrine disruptors can act on the endocrine system in several ways:

- **by interfering with hormonal receptors** (nuclear or trans membrane), by exerting an agonist or antagonist effect.
- **by interfering with the delivery of hormones to their receptors:**
  - interference in transport (transport proteins in the blood, proteins ensuring local transport, etc.)
  - interference with metabolic processes (which affects the synthesis or catabolism of hormones)
- **by causing epigenetic modifications** (e.g. post-translational modifications of histones, DNA methylation, histone variants), which affects chromatin structure and gene expression.

The effect of endocrine disruptors is not always proportional to the dose for certain parameters (**non-monotonic dose-responses**). In addition, if exposure takes place during critical periods of development, it can cause irreversible harmful effects on certain organs. Finally, the body is often exposed to **cocktails** of endocrine disruptors, which can lead to several possible effects: additive effect, synergism, potentiation, antagonism. Furthermore, among endocrine disruptors we find chemicals which are difficult to eliminate by the body (**bioaccumulation**). Finally, some endocrine disruptors cause **epigenetic modifications**, which can lead to **transgenerational effects**. For example, the epigenetic effect of diethylstilbestrol (DES) persists over three generations.

## What are the potential sources and routes of exposure to endocrine disruptors?

Nowadays, it is difficult to totally avoid exposure to endocrine disruptors. Indeed, these substances may be present:

- in **day to day consumer products** (e.g. food containers, cosmetics, cleaning products, textiles, toys, medicines, medical devices, furniture, kitchen equipment, paints, glues, insecticides, etc.);
- in **food** (e.g. migration of chemical substances from packaging, hormonal or medicinal residues in meat, pesticide or heavy metal residues in meat, fish, cereals, fruits or vegetables);
- in **the environment** (air, water, soil and plants).

A tool developed at European level (CheckED) makes it possible to assess the risk of exposure at home: [CheckED \(check-ed.eu\)](http://check-ed.eu).

An organism can absorb endocrine disruptors in different ways:

- by **inhalation** (e.g. chemical aerosols, paints, etc.);
- by **ingestion**, through food (e.g. via plastic packaging, inks, glues, recycled paper and cardboard, lacquers, endocrine disruptors naturally present in certain foods, food additives, etc.), taking medications or sucking certain items (e.g. children carrying toys or dirt in their mouths);
- by **skin contact** (e.g. cosmetics and care products, construction materials, textiles, antibacterial agents, flame retardants contained in mattresses, carpets or child seats, etc.);
- through **the blood circulation** (e.g. exposure of the fetus via the mother's placenta).

## What populations are most vulnerable and what are the critical periods of exposure?

The toxicity of endocrine disruptors is dependent on the period of exposure to these substances. Critical periods are all phases during which hormones are particularly involved in the development of an organism, in particular the prenatal period. In humans, **pregnant women** and **unborn children** are among the most vulnerable populations, as are **babies** in the early postnatal period and **young children**. **Adolescents** are also more vulnerable during puberty.

Furthermore, people with a genetic predisposition to developing certain cancers as well as **patients** suffering from a hormone-dependent pathology are also part of vulnerable populations (e.g.: cancer patients treated with chemotherapy and/or hormone therapy). In addition, certain population groups may be vulnerable due to the increased risk of exposure to chemicals, for example by living in certain areas with high concentrations of pollutants (**hotspots**).

Finally, a correlation has also been demonstrated in humans between a low standard of living and high exposure to chemical substances, at the professional or non-professional level. **Disadvantaged populations** therefore represent a category of the population that is particularly vulnerable to regular exposure to endocrine disruptors. However, this is not always the case, as certain results from human biomonitoring campaigns carried out by the Flemish Region have demonstrated.


## What are the health effects of endocrine disruptors?

Although the cause of certain diseases is often multifactorial, there is accumulating evidence that the absorption of endocrine disruptors has effects on:

- **the reproductive system:** genital malformations, cryptorchidism in newborns, puberty disorders, poor sperm quality, too low androgen levels, testicular or prostate cancer, uterine fibroids, endometriosis, benign breast problems (cysts), breast or cervical cancer, fertility problems.
- **the immune system:** disturbances of the immune system, autoimmune diseases, cancers.
- **the cardiopulmonary system:** hypertension, stroke, asthma.
- **the nervous system:** reduction in Intelligence Quotient (IQ), cognitive disorders, autism, attention deficit hyperactivity disorder (ADHD), mental illnesses, Alzheimer's and Parkinson's diseases.
- **growth**
- **metabolism:** obesity, type 2 diabetes.
- **the thyroid:** thyroid disorders.

The classification of health effects of endocrine disruptors according to the level of weight of evidence, based on a review of the literature, was established in the 2021 study : [PEPS'PE : Priorisation des effets sanitaires à surveiller dans le cadre du programme de surveillance lié aux perturbateurs endocriniens de Santé publique France - Rapport méthodologique \(santepubliquefrance.fr\)](https://www.santepubliquefrance.fr/fr/peps-pe-priorisation-des-effets-sanitaires-a-surveiller-dans-le-cadre-du-programme-de-surveillance-lie-aux-perturbateurs-endocriniens-de-sante-publique-france-rapport-methodologique).

Les effets potentiels sur la santé présentés ci-dessous sont issus de la revue de la littérature de l'étude PEPS'PE, qui classe les effets selon trois niveaux de preuves décroissants : **suffisant**, **plausible** et **insuffisant**. Ces effets ne sont pas à imputer à la seule exposition à des PE et sont, pour la plupart, multifactoriels (autres facteurs de risque : génétiques, mode de vie...).



**Cancers**

- Cancer du sein
- Cancer de la prostate
- Lymphomes et leucémies
- Cancer des ovaires
- Cancer de l'endomètre
- Cancer du testicule

**Troubles du système reproducteur**

- Endométriose
- Fibrome utérin
- Issues défavorables de grossesse
- Cryptorchidies
- Hypospadias
- Altération qualité du sperme
- Puberté précoce
- Infertilité

**Troubles métaboliques**

- Diabète de type 2
- Obésité

**Troubles immunitaires et inflammatoires**

- Maladie thyroïdienne auto-immune
- Asthme
- Allergies

**Troubles du neurodéveloppement**

- Diminution des points de QI
- Troubles du comportement
- Troubles cognitifs
- Troubles du spectre autistique
- Troubles émotionnels
- Troubles relationnels
- Troubles du déficit de l'attention avec ou sans hyperactivité

**Autres effets sanitaires**

D'après l'étude PEPS'PE, d'autres pathologies sont identifiées avec un niveau de preuves encore insuffisant, comme le syndrome des ovaires polykystiques, le cancer de la thyroïde, des anomalies de développement des dents (émail, hypominéralisation), l'hyper- et l'hypothyroïdie, etc. Ainsi, des investigations complémentaires sont nécessaires pour établir un lien de causalité avec une exposition à des PE.

\*Tous ces impacts sanitaires sont d'origine multifactorielle

However, these effects cannot be attributed to exposure to endocrine disruptors alone and are, for the most part, multifactorial. Other risk factors are notably linked to genetic inheritance, other types of exposure, lifestyle, etc.

## How can exposure to endocrine disruptors be reduced?

The Superior Health Council of Belgium published in May 2019 a scientific advisory report on **“Physical chemical environmental hygiene” (opinion no. 9404)**, which offers guidance to public health policy-makers in order to reduce the exposure of the population to chemicals.

Table 1. Some recommendations aiming at reduced exposure to health hazards.

	Recommendations	Targeted hazards			References <sup>a</sup>
		EDCs	Mutagens	Others	
Everywhere	<i>Concerning well established and important risk factors:</i>				
	Stop smoking tobacco and drinking alcohol	x	x	x	Julvez et al., 2007; Imer, 2012; Polanska et al., 2015
	Limit as much as possible passive smoking	x	x		Filippini et al., 2000; Evlampidou et al., 2015
	<i>Concerning other risk factors:</i>				
	Avoid frequent close presence to power lines; limit the use of cell phones applied against the head or cordless mobile phones			x	Tabrizi et al., 2015; Schuz, 2011; Birks et al., 2017; Zarei et al., 2015; Carlberg & Hardell, 2017; Bortkiewicz et al., 2017
	For small children: Limit the use of plastic or rubber toys and prefer products declared to be free of bisphenol A or phthalates	x			Szczepańska et al., 2016; Hashemipour et al., 2018; Andaluri et al., 2018; Liao et al., 2018
For pregnant women: Stay in a cool place in case of heat > 30°C			x	Zhang et al., 2017	
Personal care	Avoid tattoos		x		Engel et al., 2008; Chung, 2016
	Restrict the use of hair dyes and nail polish	x			Marie et al., 2016; Towle et al., 2017; Stiel et al., 2016
	Restrict the use of cosmetics and lotions as much as possible	x			Den Hond et al., 2013; Frederiksen et al., 2013; Penninkilampi and Eslick, 2018; Chow & Mahalingaiah, 2016; Darbre, 2016; Grande & Tucci, 2016; Nicolopoulou-Stamati et al., 2015; Cerna et al., 2015
	Prioritize unscented products and restrict the use of perfumes	x			Patel, 2017
Food and drinks	<i>Concerning well established and important risk factors:</i>				
	Avoid charred meat and consumption of bread or other cereal products that are darkened due to high temperature treatment		x		Fu et al., 2011; Kleinjans et al., 2015; Ngoan et al., 2009; Figg, 2012
	Avoid processed, especially nitrite treated, meat		x		Bouvard et al., 2015; Rohrmann & Linseisen, 2016
	<i>Concerning other risk factors:</i>				
	Prioritize food and drinks from glass containers instead of plastic bottles or metal cans	x			Bonde et al., 2016; Philips et al., 2017; Philippat et al., 2017; Vernet et al., 2017
	Do not microwave food in plastic recipients	x			
Avoid use of non-stick pans; cast-iron and ceramic are probably preferable	x			Kontou et al., 2013; Schlummer et al., 2015	

	Limit to once a week the consumption of predator fishes (such as tuna, swordfish)	x		x	Mergler et al., 2007
	Use quality-controlled water in glass bottles	x		x	Brender and Weyer, 2016; Komulainen, 2004; Wigle, 1998
	Prioritize organic food whenever possible	x	x		Kyriklaki et al., 2016; Brantsæter et al., 2016; Simões-Wüst et al., 2017; Baudry et al., 2018
Home care	<i>Concerning well established and important risk factors:</i>				
	Avoid or limit exposure to organic solvents		x		Lynge et al., 1997; McKinney et al., 2008; Le Cornet et al., 2017; Rodgers et al., 2017
	<i>Concerning other risk factors:</i>				
	Avoid or limit the use of insecticides	x			Llop et al., 2013;
	Avoid scented cleaning products, air fresheners and fragrances	x	x	x	Kim et al., 2015; Trantallidi et al., 2015
	When pregnant, avoid as much as possible painting or coating (walls, doors, floors, etc.)	x	x		Franck et al., 2014
	Wash new clothes before wearing them	x	x	x	Avagyan et al., 2015; Limpiteeprakan et al., 2016
	Clean inside the house using damp clothes and reduce dust	x			Roberts et al., 2009; Mitro et al., 2016
	Ventilate the bedrooms and living rooms at home for 10 min, 1-2 times a day	x		x	Larsson et al., 2009; Liu et al., 2015
Outdoor	<i>Concerning well established and important risk factors:</i>				
	Close the car windows and recycle air while driving on highways, in tunnels and in heavy traffic		x	x	Zhu et al., 2002; Zhu et al., 2006; Bos et al., 2012; Yin et al., 2017
	Prefer exercising in green areas and avoid heavily polluted air such as within 200 meters of heavy traffic		x	x	Giles & Koehle, 2014; Yin et al., 2017; Zhu et al., 2002
	<i>Concerning other risk factors:</i>				
	Avoid or limit the use of herbicides or pesticides	x	x		IARC, 2015; Myers et al., 2016; IARC, 2017; Alavanja & Bonner, 2012
Medical	Avoid exposure to medical x-rays unless really necessary		x	x	Doll and Wakeford, 1997; Wakeford and Little, 2003; Wakeford, 2008; Mulvihill et al., 2017; Bhatti et al., 2010

<sup>a</sup> For illustrative purposes a non-exhaustive list of references is included for each item.

You will also find a detailed list of recommendations issued by the competent Belgian authorities on the [FPS Health website](#), the [FPS Employment website](#) (only in French and Dutch) as well as on the website developed for awareness campaigns on endocrine disruptors ([perturbateursendocriniens.be](#)). The advice can be applied by the entire population. In addition, some tips specifically target populations most vulnerable to an exposure to endocrine disruptors, such as pregnant women.

Below you will find a list of 10 primary tips to apply in order to reduce the exposure to endocrine disruptors before or during pregnancy:

- 1. Limit the use of cosmetic products, and in particular products that remain on your skin, nails and hair (body lotion, nail polish, hair coloring, etc.). These products may contain endocrine disruptors. Choose neutral vegetable oils like sweet almond oil to limit pregnancy stretch marks.**
- 2. Avoid (re)heating food in plastic; use a glass container instead. When plastic is heated, it releases substances that can be dangerous to your health or that of your baby.**
- 3. Wash or peel your fruits and vegetables to reduce pollutants.**
- 4. Avoid using non-stick pans, pots and cookware if their coating is damaged: harmful substances can pass into your food.**
- 5. Ventilate your home twice a day for a quarter of an hour, even in winter, to remove potentially dangerous substances. They are present in some of your items (cleaning products, perfumes, glues, fumes from new furniture, dust, etc.). It is important to renew indoor air, which is often more polluted than outdoor air.**
- 6. Avoid using scent diffusers: they may contain harmful substances. If there are odors, ventilate the room.**
- 7. Clean with simple products: avoid disinfectants (products whose labels indicate "anti-virus", "effective against bacteria", etc.). Choose cleaning products with the EU Ecolabel: they are limited in dangerous chemical substances. Dust regularly with a damp cloth.**
- 8. Ask for help if you need to install or paint the nursery. Prefer paints with EU Ecolabel, ventilate regularly and plan the work well before the baby arrives.**
- 9. Wash your new clothes and those of the baby before wearing them. Textiles (clothing, sheets, towels, etc.) are often treated with potentially toxic substances.**
- 10. Learn about the risks of exposure to potentially harmful substances in the workplace. Ask your employer about the prevention policy.**

Finally, we recommend workers to inquire with their employer or professional prevention services in order to determine the potential risks linked to an exposure to endocrine disruptors at work (in particular, young workers, pregnant women or women with a pregnancy plan). In Belgium, the Code on well-being at work was revised by the royal decree of July 2, 2023, in order to strengthen prevention measures and better protect workers from potential exposure to endocrine disruptors.

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### Information sources :

- FPS Health : <https://www.health.belgium.be/en/endocrine-disruptors>
- FPS Employment : [Perturbateurs endocriniens | Beswic](#)
- National Action Plan on Endocrine Disruptors (NAPED) : [NAPED\\_2022\\_06\\_20\\_FR | FPS Public Health \(belgium.be\)](#)
- National Environment-Health Action Plan (NEHAP3) : <https://www.environnement-sante.be/fr/propos-de-nous/quest-ce-que-le-nehap>
- Advice 9404 from the Superior Health Council of Belgium :  
[Avis 9404 - Physical chemical environmental hygiene | SPF Santé publique \(belgium.be\)](#)
- Awareness campaign on endocrine disruptors: [perturbateursendocriniens.be](http://perturbateursendocriniens.be)
- CheckED: [CheckED \(check-ed.eu\)](http://check-ed.eu)