TABLE: Examples of substances that have been reported as potential endocrine disruptors

SOURCES	EXAMPLES OF USES	SUBSTANCES
Agricultural runoff Atmospheric transport Waste incineration/disposal on land)	Organochlorine compounds (pesticides and industrial products and by-products)	Dieldrine, lindane, dioxins, pp'-DDE (DDT, PCB)*
Agricultural runoff	Pesticides (currently in use)	Triazine, trifluralin, permethrin
Municipal effluent Agricultural runoff (livestock, fish farming)	Natural hormones (produced by animals and humans) Synthetic steroids (e.g., contraceptives)	17□-estradiol, estrone, testosterone, ethynylestradiol
Livestock production (agriculture, fish farming, etc.) Municipal effluents	Veterinary products (food additives) or pharmaceuticals Hygiene and cosmetic products (e.g., perfumes, deodorant, UV filters)	Parasiticide Triclosan
Industrial and municipal effluents	Alkylphenol (surfactants certain kinds of detergents - and their metabolites)	Nonylphenol
Harbours	Organotins (found in antifoulants used to paint the hulls of ships)	Tributyltin
Industrial effluents	Phthalates (found in plasticizers) Bromine flame-retardants	Dibutyl phthalate Poly brominated diphenyl ether
Paper mill effluents	Phytoestrogens (found in plant material)	Isoflavones, ligans, coumestans
Atmospheric transport	Heavy metals	Methylmercury, lead
Natural events	Forest fires	Dioxins

**Production and use prohibited in most countries since 1970*

Table based on Environment Canada table (1999)

Did you know that...?

- Diethylstilbestrol (DES) was the first substance identified as an endocrine disruptor.
- From 1948 to 1971, DES was used by millions of women to prevent miscarriages.
- DES has effects on the reproductive system of girls (abnormal vaginal cells, cancer, uterine anomalies that could result in infertility) and in boys (epididymis and testicles) who are exposed to DES during prenatal development.

To learn more

Berryman D. et al. (2003) Suivi des nonylphénols éthoxylés dans l'eau brute et l'eau traitée de onze stations de traitement d'eau potable au Québec. Ministère de l'Environnement. 32 p. http://www.mddep.gouv.qc.ca

Canadian Centre for Occupational Health and Safety (CCOHS). Endocrine disrupting substances. http://www.cchst.ca

Colon I. et al. (2000). Identification of Phthalate esters in the serum of young Puerto Rican girls with premature breast development. Environmental Health Perspectives 108(9): 895-900

Comité de la prévention et de la précaution (2003). Les perturbateurs endocriniens : quels risques ? Ministère de l'Écologie et du Développement durable. France. http://www1.environnement.gouv.fr

Dewailly É et al. (2002). Surveillance program for the pre-natal exposure to organochlorine compounds in populations residing in the North Shore region of the St. Lawrence River. Human Health component of St. Lawrence Vision 2000. (Full report available only in French.)

Dewailly É et al. (1998) Évaluation de l'exposition prénatale aux organochlorés, aux métaux lourds et aux acides gras omega-3 des populations de la Moyenne et de la Basse Côte-Nord du Saint Laurent (Environmental Health Study on North Shore Newborns) (St. Laurent Vision 2000 report). 87 p. + appendices.

Environment Canada (1999). Endocrine Disrupting Substances in the Environment. http://www.ec.gc.ca

Gérin M. et al. (2003). Environnement et santé publique. Fondements et pratiques. Tec & Doc, 1023 p.

Golden R.J. et al. (1998). Environmental endocrine modulators and human health: an assessment of the biological evidence. Critical Review in Toxicology 28(2): 109-227.

Institut National de Recherche et de Sécurité (INRS (2000). Le point des connaissances sur les perturbateurs endocriniens. http://www.inrs.fr

Institut National de Recherche et de Sécurité (INRS (2000). Documents pour le médecin du travail, N° 92. Perturbateurs endocriniens et effets toxiques Perturbateurs endocriniens et risques professionnels. http://www.inrs.fr

International Program on Chemical Safety (IPCS) (2002). Global Assessment of the State-of-the-Science of Endocrine Disruptors. WHO/PCS/EDC/02.2 http://www.who.int

L'Encyclopédie de l'Agora: perturbateurs endocriniens. http://agora.qc.ca

Mackenzie C.A. et al. (2005) Declining Sex Ratio in a First Nation Community. Environmental Health Perspectives 113(10): 1295-1298.

Safe S. H. (2000) Endocrine Disruptors and Human Health: Is there a problem? An update. Environmental Health Perspectives 108(6): 487-493.

Photographic credits: Aurélie Delaurière, Harold Vigneault, Jean-François Larose.

ISBN: 0-662-42674-6
Catalogue No.: H21-263/2006E

This summary information sheet was produced jointly by Health Canada, Environment Canada and Stratégies Saint-Laurent.
This project was carried out in part under the St. Lawrence Action Plan, which is governed by a Canada-Quebec Memorandum of Understanding.
This publication is available on the Internet at http:// www.strategiessl.qc.ca/
Également disponible en français.

Government of Canada / Gouvernement du Canada

KEYS TO UNDERSTANDING AND COMMUNICATING ENVIRONMENTAL HEALTH ISSUES

Presence of endocrine disruptors in the aquatic environment

Endocrine disruptors (ED) are natural or synthetic chemical substances that can influence the development, growth, reproduction and behaviour of animals and humans by disturbing the endocrine system.

What is the endocrine system?

Endocrine systems are complex mechanisms involving organs (glands) that secrete hormones. The hormones released into the blood stream transport messages from the producing gland to the receiving organ. The message once received then triggers a biological response.

Endocrine systems include a number of organs (pituitary gland, thyroid, adrenal gland, testicles, ovaries) in different parts of the body (head, neck, abdomen, reproductive system).

How and where do endocrine disruptors operate?

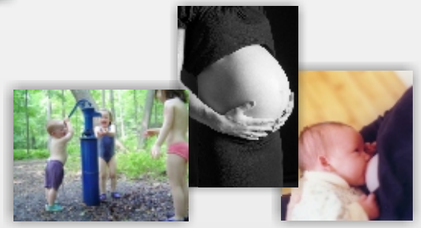
EDs can stimulate or block the action of normal hormones, and as a result disrupt normal functions.

What are the sources of EDs?

Substances that can impact the endocrine system include natural human, animal or plant (phytoestrogens) hormones as well as synthetic (manufactured) substances. The synthetic substances vary and include such substances as synthetic hormones, organochlorine compounds, pesticides, plasticizers, organo-metallic compounds, and heavy metals (see table).

Potential effects on human health

Effects on development, growth, reproduction and behaviour have already been observed (in animals and humans) in environments highly contaminated with EDs, but causal links have rarely been established with any degree of certainty. Moreover, there is currently no evidence that low concentrations of EDs in the environment can produce any such effects. Health authorities, however, are closely monitoring developments in this field.



Scientific research

Initial research focused primarily on persistent, bioaccumulating, toxic substances, such as organochlorines. More recent research has focused on substances not so highly persistent, but still widespread in the environment.
The disruption of endocrine functions by suspect EDs during prenatal or postnatal development is one of the hypotheses research scientists are investigating.
One of the objectives of current research is to determine whether prenatal (*in utero*) exposure to endocrine-disrupting substances (that mimic estrogens) is the source of adverse effects such as cancer (breast, endometrial, prostrate or testicular), loss of reproductive function in men and women, behavioural changes, slow learning or changes to the immune system or thyroid function. Current data indicate that prenatal exposure to EDs can have an effect on weight (low) of newborns and on the cognitive development and behaviours of these children.

Canada

PRESENCE OF ENDOCRINE DISRUPTORS IN THE ENVIRONMENT

ENVIRONMENT

Aquatic environment
- Source of drinking water affected?
- Surface water
  - Subject to many sources of ED (see table)?
  - Specific local sources?
- Persistence (e.g., organochlorines or metals)?
- Transfer to food chain?
  - Bioconcentration, bioamplification (predators : fish, birds, marine mammals, etc.)

Air
- Atmospheric transport (e.g., DDT or PCBs).
- Indoor/outdoor air exchanges.

Soils
- Plant contamination (phytoestrogens found naturally in plants).
- Livestock contamination (meat, milk, eggs) and game.

Potential effects on ecosystems
- Effects on reproduction, development and immune system of exposed specimens (e.g., fish, crustaceans, molluscs or amphibians)
  - Possible decline in populations over long term.

HUMAN HEALTH

How could human beings be exposed to EDs?
- By ingestion of drinking water, food (e.g., organochlorines in fish) and synthetic hormones, or through recreational water activities.
- Through mother-child transfer during pregnancy (*in utero* exposure of foetus) and breast-feeding (to organochlorines).
- By dermal contact during swimming or baths/showers, or with hygienic and cosmetic products.
- By inhalation of indoor or outdoor air.

What are the potential effects?
- Reproduction-related problems in men and women.
- Change in proportion of girls and boys (e.g., 2 to 1 ratio of girls to boys born in First Nations population in Ontario).
- Effects on child development (e.g., early puberty).
- Immune system changes.
- Depressed thyroid function.
- For the moment, no causal link established with cancer.

Does the presence of low concentrations of EDs pose health risks?
- Effects of EDs on human health: observed in individuals with high exposure (those living near industrial facilities that discharge EDs into the environment).
- Are there any significant effects of low-level exposure to EDs in human beings: research is ongoing.

COMMUNITY

What are the socio-economic effects?
- Loss in revenues (e.g., subsistence fishing).
- Changes to commercial, tourism, agricultural/fish farming or industrial activities.
- Potential impact on public safety (drinking water quality, recreational activities or fish resources).

What are the socio-cultural effects?
- Changes to quality of life or lifestyles (e.g., restricted fish, shellfish and egg consumption).
- Loss of traditional values and customs (First Nations).

What are the psychological factors?
- Stress associated with health risks, risk to children, fear of transmitting health problems to children or of not being able to have children.

Who are the most vulnerable groups?
- Foetuses, children, adolescents (during puberty).
- People who consume considerable amounts of potentially contaminated foods (such as fish).

COMMUNICATING HEALTH RISKS

Lifestyles that expose people to EDs

Smoking, the use of contraceptives and certain hygiene and cosmetic products, and consumption of some foods (e.g., plants rich in phytoestrogens such as legumes and in particular soy) all result in exposure to EDs.

Sending out a clear message
- Potential effects of low-level exposure still poorly understood.
- Research currently underway (on causal links and low-dose effects).
- Communicate findings without alarming the general public because research is still in its infancy in this area.

Inform and reassure
- Contribution of natural sources (e.g., fruits and legumes).
- Provide information on benefits/high risk of certain foods (e.g., beneficial effects of fruits and legumes).
- Explain how to reduce exposure and make lifestyle changes.
- Keep the general public well informed (join forces with established organizations) and provide straightforward answers to questions/concerns.

"We're taking care of you."
- Should local environmental data be collected (e.g., water measurements or fish resources)?
- Should the general public be monitored?