



# ENDOCRINE DISRUPTIN CHEMICALS AN WEEMEN'S REPRODUCTIVE HAIL

FACTSHEET

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# ENDOCRINE DISRUPTIN CHEMICALS (EDCs) AN WEEMEN'S REPRODUCTIVE HAIL

This factsheet wis scrievit bi FREIA an  
the hail an Environment Alliance (HEAL)  
an is endorsed bi  
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*A glossary o a puckle o the terms eesed in this factsheet can be fand on page 12*

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## TACKLIN THE MAITERS O EDCs

FREIA aims tae whack oor scientific finnings tae gie a heeze tae a sustainable society an improve the hail o weemen



**ADVANCE EDC TESTING FUR  
MAIR PROTECTIVE  
CHEMICALS REGULATION**

**BETTER INFORMATION  
ABOUT EDCs FUR HEALTHIER  
LIFESTYLE CHOICES**



# WEEMEN'S HAIL MATTERS



It is ayont aa doot aat endocrine kerfufflin chemicals (EDCs) impact the hail o humans knowt an the environment ower the world. O a winner we still dinna ken exactly fit EDCs can herm female reproductive hail This is een o the rizzons aat we currently hiv nae guid test wyes an regulatory procedures tae address this.

The European Commission his fundit eicht research projects tae improve test methods fer EDC identification. Een o these projects is caad FREIA Female Reproductive toxicity o Endocrine kerfufflin chemicals EDCs a human evidence based screenin an Identification Approach aifter the Nordic goddess o fertility.

This factsheet gives an owersicht o fit is currently kent eenoo EDCs an their impact on weemen s reproductive hail. It highlights the challenges o adequately regulate EDCs in European chemical regulations an fit FREIA aims tae dee tae mak this better.



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## FIT WYE FOCUS ON WEEMEN'S REPRODUCTIVE HAIL?

Gweed reproductive hail is important fer the weelbein o weemen an, gin they wish tae conceive, fer the weel bein o their geets an future generations. The nummer o weemen wi reproductive hail problems is increasin warld-wide.

A wifie's reproductive hail is already gey near establishet early in her lyffe durin embryonic an fetal development in the wyme. It matures durin puberty an hormones play a crucial role aat ilkae step o development. Hormones are gey critical in maintainin reproductive hail in the reproductive years an ayont. It is clear aat a wifie's reproductive hail is sensitive tae chemicals aat kerfuffle hormonal processes aat aa phases o her lyffe.

We are aa exposed tae a heeze o different chemicals in oor iveryday lives including those aat can disturb hormonal processes. Thon chemicals are kent as hormone or endocrine disrupting chemicals (EDCs).

***Reproductive hail is "a state o complete physical mental an social weel bein an nae jist the wint o disease or infirmity in aa maitters about the reproductive system an tae its functions an processes".***

*United Nations<sup>i</sup>*

A clear example o fit disruption o hormones can dee tae weemen's reproductive hail is the DES mishanter, far overt reproductive effects hiv been described in weemen an their geets aifter takkin the synthetic estrogen diethylstilbestrol, DES, as a drug durin pregnancy<sup>ii</sup>. The contermashious effects o this drug are still apparent even three generations doon the line.

Eenoo, we still hiv muckle gaps in unnerstaunin fit wey endocrine kerfufflin chemicals, EDCs, can affeck weemen's reproductive hail. This maks it deefficult tae identiffee, regulate, an take protective meisures agin chemicals aat can kerfuffle hormonal processes.

## ENDOCRINE KERFUFFLIN CHEMICALS (EDCs)

Hormone or endocrine disrupting chemicals, EDCs, are affen man vrocht chemicals aat ficher wi the production, transport, excretion, an/or function o hormones.

Thegither wi the neurological an immune systems, the hormone or endocrine system is een o oor three main communication systems within the body. Hormones are makkit in glands an tissues, secreted into the bleed, an taen tae hyne aff target organs tae regulate biological processes.

Fin normal hormonal signaling is kerfuffled bi EDCs, this micht lead tae adverse hail effects<sup>iii</sup> Scientific evidence shows aat exposure tae EDCs can hiv profun effects on a wifie's reproductive hail.

Exposure tae endocrine kerfufflin chemicals happens daily, inbye an ootbye, at hame, in the office, at skail or at daycare airts. EDCs can be funn in mony products aat we eese ilkie day fae hoosehold an personal care producks tae plastic maet packages. A when pesticides used fer agricultural eese or aat hame are EDCs tee.

We are exposit via the air styoo, maet, an satty bree or via oor skin. EDCs can be transferrit fae the pregnant wifie tae the growin fetus or bairn ben the placenta an breist milk<sup>iv</sup>.

A WHEEN HORMONE RESPONSIVE  
TISSUES AN ENDOCRINE GLANDS  
IN WEEMEN AN THE HORMONES  
THEY MAKE<sup>v</sup>

**HYPOTHALAMUS**  
*GnRH*  
**PITUITARY**  
*FSH, LH, TSH*

**THYROID**  
*T3, T4*

**BREIST**  
*estrogens*

**ADRENAL**  
*androgens*

**UTERUS**

**OVARY**  
*estrogens,  
progestagens*



## EXAMPLES O KENT AN JALOUSSED ENDOCRINE KERFUFFLIN CHEMICALS AN FAR TAE FINN THEM



Plastic maet packages micht contain **BISPHENOL A (BPA)**, or **PHTHALATES** sic as DEHP, whilk hiv bin identifeed as substances o gye heich consarn bi European regulators fer their endocrine kerfufflin properties. BPA is eesit in the makkinn o hard-vrocht plastics or tae haud aff corrosion o tin cans, whereas phthalates are eesit as plastic saffeners.

Fruits an veggies micht contain residues o **PESTICIDES**, whilk hiv been documented fer their effects on the endocrine systems, sic as chlorpyrifos, prochloraz, an ketoconazole.



Satty bree an blad repellent coatings used in mony consumer products, sic as non-stick cookware, raincoats, carpets an furniture, contain **PERFLUORINATED CHEMICALS (PFAS)**, sic as PFOS an PFOA, whilk ficher wi endocrine activity.

**ANTI-MICROBIAL CHEMICALS**, sic as triclosan an triclocarban, eesit in personal care products, micht be endocrine kerfufflers as weel. Ither examples are **PHTHALATES**, DEHP DMP DEP an DBP, or **PARABENS**, whilk are commonly eesit in fit mak nail blaik less brittle, hairspray raxxy, or as solvents in perfumes.



## WEEMEN'S REPRODUCTIVE HAIL CHALLENGES

In ilkae stage o a wifie's lyffe, hormones play important roles in development maturation an normal functionin o her reproductive system. Kerfufflin o hormonal balance is affen the cause o reproductive hail issues in weemen.

Kent factors that can affeck reproductive hail are bein creashie, smoking, age at first menstruation, age at menopause, age

at first childbirth, an duration o breistfeeding/ Apairt frae thon weel-kent factors exposure tae EDCs has likewyse bin associatit wi puckles o hail conditions. These include problems durin pregnancy an or at drappit early puberty menstrual irregularities, polycystic ovary syndrome (PCOS), endometriosis, breist cancer, or early menopause, premature ovarian insufficiency or failure)<sup>vi</sup>.



INFERTILITY  
1 in 6 couples



POLYCYSTIC OVARY  
SYNDROME (PCOS)  
5-15% o weemen



BREIST CANCER  
1 in 8 weemen



IRREGULAR  
MENSTRUAL CYCLES  
50 per 1000 weemen



ENDOMETRIOSIS  
10% reproductive-age  
weemen



EARLY MENOPAUSE  
1 in 250 weemen  
bi age 35 years

## THE PRICE WE AA PEY

In Europe alane, the wecht o diseases as a consequence o exposure tae endocrine kjerfufflin chemicals (EDCs) is estimated tae cost at least 163 billion euros ilkae year. This is aroon 325 euro fer each European citizen ilkae year<sup>vii</sup>.

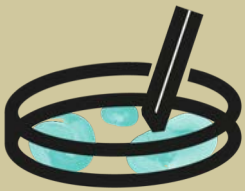
Pairt o these costs is relatit tae weemen's reproductive hail issues, sic as uterine fibroids (163 million) an endometriosis (1.25 billion)<sup>viii</sup>.

It is hard tae gie a cost estimate fur female infertility due tae EDC exposure kis the rizzen eur nae becoming pregnant is affen unexplainit an may be causit bi female factors, male factor,s or a mellin o baith. It is clear, though, aat the demand fer assistit reproductive techniques (ART), sic as in vitro fertilization (IVF), has risen ower the hinmaist 40 year. The contribution o EDCs tae the cost associatit wi ART is estimated at 4.7 billion eurs<sup>vii</sup>.

# FIT WYE ENDOCRINE KERFUFLIN CHEMICALS MAITTER



**EDCs are aawye** in oor environment. This means aat weemen can be exposed, fer example via maet, satty bree, personal care products, furniture an pharmaceutical drugs. Healthy lifestyle choices can lower oor exposure, bit maistly ambitious public policies are nott tae regulate EDCs better.



EDC effects are largely overlukit in chemical regulations eenoo. This is paitly due tae the **faut o adequate test wyes**.



EDCs can hiv **effects aat gye laich doses** aat are usually thocht safe fer consumers accordin tae traditional weys o jelousin risk.



There are **lyffe stages** in whilk weemen are gey sensitive fur hormone disruption, e.g. in the wyme, as newborns, as hauflins unnergaun puberty, as pregnant wifies. Exposure tae EDCs during these susceptible periods in her lyffe micht cause irreversible damage tae a wifie's hail.



Effects o EDCs micht nae be sae apparent at first sicht. Effects fae exposure in the wyme might anely becam **veesible later in lyffe**, fer instance fertility problems. EDCs micht affeck multiple generations, tee, as is seen wi diethylstilbestrol (DES).

## THE TIMIN MAKS THE PYSON

Many concerns about reproductive effects in humans and wildlife stem from findings linking exposure to endocrine disrupting chemicals (EDCs) in the womb, the decline in sperm counts and growing prevalence of undescended testis, testicular cancer, and urinary duct malformation in children<sup>ix</sup>.

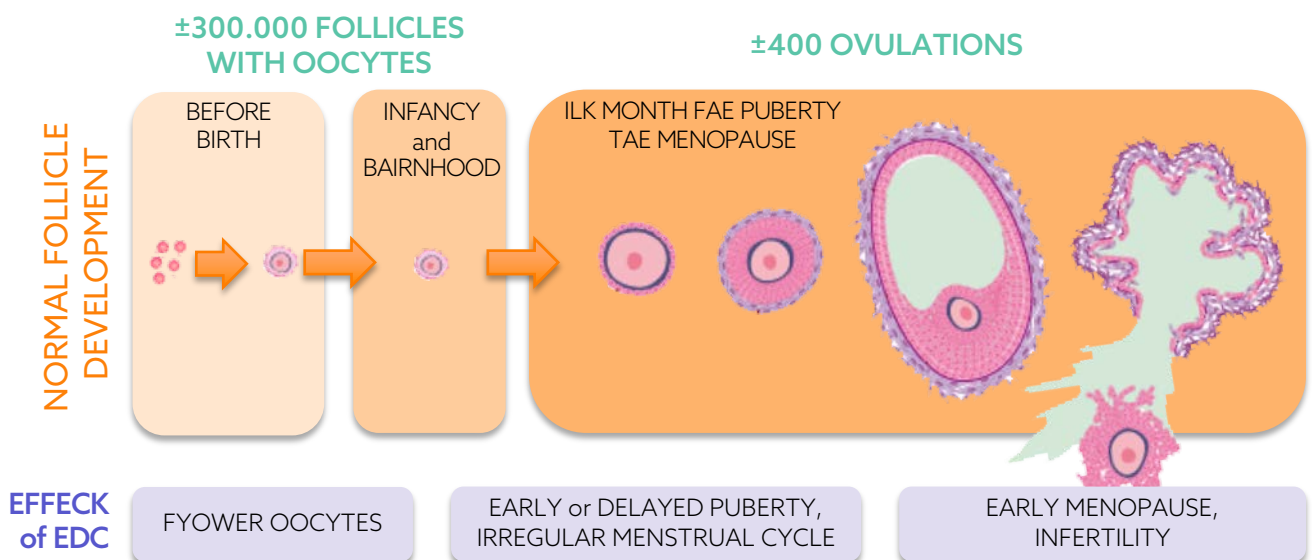
The effects of EDCs might have on female reproduction have been misinterpreted for many years. This is thought, considering that the finite reserve of eggs is clearly a significantly more limiting factor in human reproduction than the making of sperm.

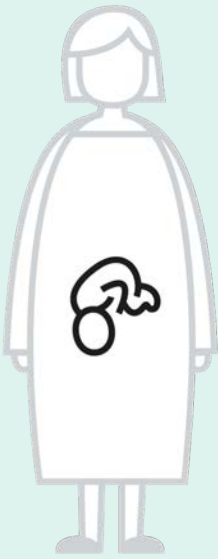
In the case of unborn children and an adult woman, many hormonal processes are activated or reactivated leading to a peak in phases in life during which she is sensitive to EDC exposure.

Depending on the life stage at which EDC exposure occurs, different effects might arise due to differences in basic follicle biology in the embryo/fetus/young child, adolescent, and adult woman<sup>x</sup>. The effects of EDC exposure during early life might be activated or become worse due to additional EDC exposure as a woman's life.

The growing understanding of EDCs has changed the ways we view toxic actions. Traditionally, toxicology has primarily focused on the chemical - the dose makes the poison. It is not clear at the state or life stage of the targeted organism is also critical. Taking into account timing in the toxicological and regulatory sciences is a great challenge, but it will certainly lead to more protective chemical regulations in the EU and beyond<sup>xi</sup>.

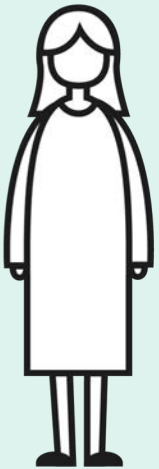
### STAGES OF OOCYTE DEVELOPMENT EXPOSURE TO EDCS AT DIFFERENT LIFE STAGES LEADS TO DIFFERENT EFFECTS





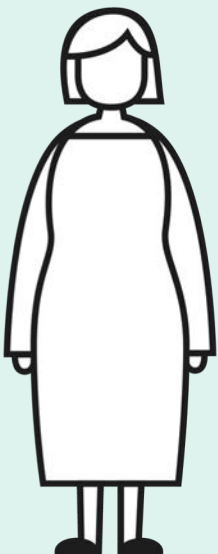
## IN THE WYME

Aifter decades o clinical eese, it wis fun oot at DES causes cancer o the female reproductive tract, spyles fertility, endometriosis, an earlier menopause in the dochters born fae weemen takkin these drugs durin pregnancy. This shows at female reproductive disorders in adulthood can stert fae hormonal chynges durin development. A bairn-quine hai about three hunner thoosand primordial follicles containing immature aiggs or oocytes. Fyles we hiv some information fae animal studies, the effects o EDCs on ovarian development in the human fetus, an the number an quality o oocytes, are still unkent.



## PUBERTY

In quines, puberty sterts maist times atween the ages o 10 an 14, wi activation o hormonal signaling. Aifter at, ovarian follicles are whylesy recruitit tae restert growth an mature. Baith hormonal signaling an pubertal onset are susceptible tae disturbances resultin fae EDC exposure, sic as phthalates an bisphenol A. Fer example the role o EDCs in early breist development in quines his increasinly been spukken aboot ower the hinmaist decade. Clearly, EDCs can affeck processes at merk the stert o puberty. Yet the exack processes at trigger effects on puberty still need tae be clarifeet.



## ADULTHOOD

During a wifie's reproductive years, atween 15 an 49 years o age, ootbye o pregnancy an breastfeeding, in the ordnar wye, anely a single oocyte completes the maturation process ilkae month, until menopause marks the eyn o the ability tae faa wi a bairn. Aboot 400 follicles'll eventually mature tae the ovulatory stage durin a wifie's lyffe. Tae maintain the periodical maturation o oocytes an hiv a regular menstrual cycle, the richt sup o hormones need tae be vrocht bi the ovaries aat the richt time. Some EDCs are kent tae affect the makkin o hormones, bit it is yet tae be kent fit wey inbye the ovary. Whither EDCs can affeck growth, maturation, an acceleratit loss o follicles has nae yet been thoroughly seen till.



# TESTING AND REGULATING ENDOCRINE DISRUPTING CHEMICALS IN EUROPE

European law requires chemicals to go through a safety evaluation before being allowed on the market. The type of information that needs to be given by industry to the regulators depends on the type of chemical to be evaluated, e.g. a pesticide, biocide, or industrial chemical.

Regulators assess the endocrine disrupting properties of a chemical mainly based on data from standard test protocols that are agreed upon by the Organisation for Economic Co-operation and Development (OECD)<sup>xii</sup>. However, currently available protocols are not well suited to study the effects of EDCs on important health effects including effects on female reproductive health. This is especially the case for effects as a result of early life exposure in the womb, during childhood and puberty, as a woman's body is still under development<sup>xiii</sup>.

The process to identify an EDC differs between chemical regulations. Specific identification criteria for EDCs only exist for pesticides and biocides. In the case of endocrine disrupting properties of industrial chemicals, they are assessed on a case-by-case basis based on existing scientific

evidence and expert opinion. Other regulations addressing the safety of chemicals in consumer products, such as cosmetics, toys, or food contact materials, currently do not have specific identification processes for EDCs<sup>xiv</sup>.

The lack of coherent identification processes for EDCs across chemical regulations has increasingly come under the spotlight of European policy debates<sup>xv</sup>. This has led the European Commission to commit to updating its strategy on endocrine disruptors<sup>xvi</sup>. The previous one dates back to 1999. Upon taking office in late 2019, the European Commission President, as well as Environment and Health Commissioners, have committed to making endocrine disruptors a high priority during their mandate.



*"Europe needs to flit to a zero pollution ambition, I'll put forward a cross-cutting strategy to protect citizens' health from environmental degradation and pollution, addressing air, and water quality, hazardous chemicals, industrial emission, pesticides, and endocrine disruptors."*

*Ursula van der Leyen, 2019, President of the European Commission<sup>xvii</sup>*



## CARIN AND SHARING FER A SUSTAINABLE FUTURE

Exposure tae endocrine disruptin chemicals (EDCs) can lead tae seriously kerfufflin hail problems an diseases. This means at properly addressin EDCs in chemical regulations, science, education, an hail care can also help tae prevent diseases an stimulate a healthy an sustainable society.

Sharing scientific findins is instrumental fer informing society aboot the potential hail risks o EDCs. Here, medical an reproductive hail communities play important roles in translatin science intae practical advice fer female patients.

It is maist important tae train an educate younger fowk aboot the science ahin potential hail risks o chemical exposures an the positive hail effects lyffe style choices can hiv .

The youth o the day are oor future politicians. healthcare professionals. Scientists. chemical producers, an micht become aul fowk on the wa tee. Engaging the day's youth fowk in the environmental hail debate will makk sicca o a healthier society fer generations tae come.

*"Byordnar increases in exposure tae toxic chemicals in the hinmaist fower decades is threatenin human reproduction an hail"*

*International Federation of Gynecology and Obstetrics (FIGO)*



The FREIA prottick is gaen ower tae safeguairdin weemen's reproductive hail agwen endocrine kerfufflin chemicals tae achieve this goal we ah'll...



...bigg spleet new unnerstaunin an insichts intae coorse effects o endocrine disruption on weemen's health.



...makk spleet new test wyes an improve existin eens tae deteck EDCs aat are toxic tae weemen's reproduction in order tae support protective chemical regulation.



...gie a heeze tae sustainable options fer a healthy society an improve the hail o weemen worldwide.

## FREIA CONSORTIUM

The FREIA consortium consists of eleven partners with outstanding scientific and regulatory expertise on endocrine disruption in relation to women's reproductive health, early life development, epidemiology, endocrinology and toxicology.

We work closely with sixteen other EU funded projects in a consortium called EURION (European Cluster to Improve Identification of Endocrine Disruptors). These projects develop test methods to identify EDCs that cause thyroid hormone disruption, developmental neurotoxic effects, and metabolic diseases. For more information visit: [www.eurion-cluster.eu](http://www.eurion-cluster.eu)



## FREIA PARTNERSHIPS

The Health and Environment Alliance HEAL is our strategic partner for policy and advocacy actions as well as dissemination and communication on health protection.

We have established partnerships with the International Federation of Gynecologists and Obstetrics (FIGO)<sup>xviii</sup> and the International Federation of Fertility Societies (IFFS), both major actors in advocating and communicating actions to promote women's health and a healthy society.





# GLOSSARY

**Breast cancer** lifetime risk is about 1 in 8 weemen Genetics rikkin age aat first menstruation an onset o menopause age aat first child duration o breastfeeding are kent tae affect a wifie s chunce o developing breist cancer. EDCs linked tae breist cancer include DES BPA early lyffe exposure tae DDT an dioxins.

**Endocrine disrupting chemical (EDC):** " an exogenous substance or mixture aat alters function s o the endocrine system an consequently causes adverse hail effects in an intact organism its progeny or sub populations according tae the 2002 definition o the World Health Organization.

**Endometriosis** is a condition in whilk the tissue aat normally lines the inside o the uterus also grows ootbye the uterus affen in the pelvic area ovaries an Fallopian tubes. Endometriosis is a trachle condition whilk increases the risk fur infertility It affects 10 15 o weemen in reproductive age. Endometriosis is linked tae DES phthalates an persistent organic pollutants sic as anti malaria compound DDT.

**Hormones** are chemical messengers in oor body Some hormones stimulate the release o hormones in ither glands sic as GnRH gonadotropin releasing hormone. Others stimulate the production o hormones sic as FSH (follicle stimulating hormone), LH (luteinizing hormone) an TSH (thyroid stimulating hormone). Some hormones hiv direct effects on a target cell sic as thyroid hormones (T3 triiodothyronine an T4 thyroxine), estrogens (e.g. estradiol), androgens (e.g. testosterone) an progestogens (e.g. progesterone).

**Infertility** is the inability tae conceive a child about 1 in 6 8 couples hiv troubles gettin pregnant or staying pregnant aire are mony causes fur infertility an involve female (20-30%), male (20-30%) factors, baith male an female or unexplained factors (40%). Female infertility mye hiv a plethora o underlying causes including endometriosis disorders related tae ovary dysfunction sic as PCOS bit also factors like infections an lifestyle. Fertility issues are linked tae DES BPA an phthalates.

**Irregular menstrual cycles** mye in itsel occur during puberty particularly aat the yoke o puberty as it mye take een or twaa years fur menstrual cycles tae become regular fin three or mair periods are missed this is referred tae as amenorrhea. This mye occur as a result o natural causes (fur example pregnancy) bit also as a side effect o medication sic as antidepressants or hormonal disbalance.

**Polycystic ovary syndrome (PCOS)** is a hormonal condition weemen wi PCOS produce mair male hormones nor normal. Symptoms include abnormal menstrual cycles an over the heid hair growth PCOS is the maist common cause o infertility in weemen PCOS is linked tae BPA.

**Premature ovarian insufficiency or failure (POI).** weemen hiv POI fin the ovaries hiv a reduced estrogen production or release fewer aiggs afore the age o 40. The result o POI is infertility weemen mye also experience symptoms similar tae menopause as a result o laich estrogen levels. Contrary tae menopause though weemen mye still occasionally or irregularly hiv a period an become pregnant.

An **oocyte** is an immature aigg. Oocytes are enclosed bi specialized cells thegither caad the follicle. A wifie is born wi aa the follicles she ah'll iver hiv. Typically ilky month een oocyte ah'll become a mature aigg. During this process the follicle enlarges an becomes fult wi follicular fluid eence matured the oocyte or aigg ah'll be released fae the ovarium ovulation an is riggit tae be fertilized bi sperm.

**Ovarian cysts** are fluid fult sacs in or on the ovary maist cysts are harmless an ah'll disappear athoot treatment. Some ovarian cysts mye develop as a result o endometriosis or PCOS an cause serious symptoms sic as pelvic i've a stoonin in my kistie an bloating.

**Reproductive health** is "a state o complete physical mental an social weel bein an nae merely the absense o disease or infirmity in aa matters relating tae the reproductive system an tae its functions an processes according tae the United Nations<sup>1</sup>.

**Uterine fibroids** occur in 25-50% o aa weemen. Uterine fibroids are muscle cells an tissues aat grow in an aroon the waa o the uterus an can cause pelvic i've a stoonin in my kistie abnormally heavy periods abnormal uterine bleedin infertility an complications in pregnancy Uterine fibroids are linked tae DES BPA an organochlorine pesticides sic as DDT an dieldrin.



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# SAFEGUARDING WOMEN'S REPRODUCTIVE HEALTH AGAINST ENDOCRINE DISRUPTORS

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