Institute for Environment and Health

Chemicals purported to be endocrine disrupters

A compilation of published lists

INCLUSION OF A PARTICULAR SUBSTANCE IN THIS REPORT SHOULD NOT BE TAKEN TO CONSTITUTE ANY ENDORSEMENT OF ITS STATUS AS A PROVEN OR POTENTIAL ENDOCRINE DISRUPTING OR MODIFYING AGENT BY EITHER IEH OR DEFRA

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Summary

This report, prepared by the MRC Institute for Environment and Health (IEH) for the Department for Environment, Food and Rural Affairs (Defra), presents a consolidated listing of those chemicals that have been suggested in the published literature to be potential endocrine disrupters. The report is in large part based upon information extracted from various reports and listings produced by national or international governmental and non-governmental organisations. The information so derived has been supplemented with further data extracted from published original studies or review articles, identified in peer-reviewed journals published from 2000–2002. The resultant consolidated compilation contains a total of 966 compounds or elements; for convenience these have been divided into six categories.

The largest group are the general anthropogenic chemicals[1], consisting of 539 individual chemicals, metabolites or degradation products. The second largest category constitutes the biocides, and includes 225 chemicals, metabolites or degradation products. The third category comprises biogenic compounds, that is those of natural origin, that have been suggested as having endocrine activity; this comprises 62 substances. The other categories are: pharmaceuticals (58 substances); inorganic compounds and organo-metallic complexes (54) and consumer products (28).

In addition to preparing the list of compounds, the number of sources or papers identifying a given compound was assessed. It was apparent that the majority of the chemicals in the anthropogenic, biogenic, inorganic/organo-metallic substances, pharmaceutical and consumer product categories were each cited in only one source document. In contrast, the majority of biocidal products had each been identified as an established or potential endocrine disrupter by three or four different sources.

It was noted during review of the source documents that, in some instances, there were factual errors and inconsistencies. This raises questions about the validity of some aspects of the sources used, and it must be stressed that inclusion of a particular substance in the listings in this report is based solely on its inclusion in one or more of the reference sources. Inclusion of a particular substance in this report should not, therefore, be taken to constitute any endorsement of its status as a proven or potential endocrine disrupting or modifying agent by either IEH or by Defra.

[1] Compounds of anthropogenic origin excluding biocides, pharmaceuticals, consumer products, and inorganic, organo-metallic or biogenic materials, which are tabulated separately

1 Introduction

During recent years, various international and national governmental bodies, and non-governmental organisations, have published inventories of chemicals purported to possess endocrine disrupting activity. These lists of endocrine disrupters (EDs) have been produced for a variety of reasons; for example, to aid in the development of environmental management strategies, to identify gaps in knowledge and future research needs, or to inform the regulatory and scientific communities, or the general public, of chemicals of potential concern.

This report was commissioned by the Department for Environment, Food and Rural Affairs (Defra) to provide an easy-to-access listing of the chemicals that have been suggested to be EDs, and to assist in the future targeting of chemicals for further consideration.

The consolidated listing presented in this report represents an update (to 2002) and extension of an informal inventory of chemicals originally prepared by the MRC Institute for Environment and Health (IEH) for the then Department of the Environment, Transport and the Regions (DETR) in February 2001. It complements work already undertaken by IEH on various aspects of the endocrine disruption issue, including the development of a relational database designed to assist in the prioritisation of EDs (IEH, 2002).

2 Methods

The development of the lists presented in this report involved a number of activities. Initially, identified published listings of chemicals suspected or claimed to be endocrine disrupters (EDs) were collated. These were then supplemented with information derived from review articles or original papers published in peer-reviewed journals from 2000–2002. Efforts were made to verify the information derived from these sources through cross-referencing against on-line databases and by further searches of the Internet. The various stages and procedures adopted are described in detail below.

2.1 Identification and collation of existing listings of substances purported to be endocrine disrupters

As part of its ongoing interest in the topic of endocrine disruption, the Institute has sought, since 1999, to identify the various listings or databases relating to established or potential EDs that have been produced by governmental, non-governmental or industrial bodies. All such information has been collated and transferred to a consolidated list. The following sources were used in the compilation of this report:

BKH report for the European Commission

BKH Consulting Engineers, commissioned by the European Commission (EC), published a report entitled *Towards the Establishment of a Priority List of Substances for Further Evaluation of Their Role in Endocrine Disruption* in 2000 (EC-BKH, 2000). It is an inventory of previously published lists of anthropogenic chemicals reported as either being EDs or suspected as having endocrine disrupting properties. In the report, the 553 chemicals identified were prioritised in terms of their environmental persistence and exposure, their status as high production volume chemicals, and the strength of scientific evidence for their having endocrine disrupting properties. In this way they were classified into three groups.

- Group I, 60 compounds for which there was considered to be evidence of endocrine disrupting activity and for which a high level of concern existed with regard to exposure;
- Group II, 55 potential endocrine disrupters or compounds for which there was a medium level of concern with regard to exposure; and
- Group III, 438 compounds for which there was considered to be insufficient evidence of endocrine disruption or for which there was only low concern with regard to exposure.

Environmental Defense — Scorecard

Scorecard is an internet-based database (SC, 2002), maintained by the US non-profit organization Environmental Defense, that purports to include information from State and Federal databases on chemicals in relation to various environmental problems and health effects of relevance to the USA. With regard to endocrine disrupters, the database is said to be based upon the sources listed below.

Brucker-Davis F (1998) Effects of environmental synthetic chemicals on thyroid function. *Thyroid*, *8*, 827–856

C EPA (1997) *Draft Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels,* Oct 1997. Office of Environmental Health Hazard Assessment, Californian Environmental Protection Agency

C EPA (1999) *Air Toxics Hot Spots Program Risk Assessment Guidelines, Part III, Draft Technical Support Document for the Determination of Noncancer Chronic Reference Exposure Levels,* June 1999. Office of

Environmental Health Hazard Assessment, California Environmental Protection Agency, available [January 2005] at http://www.oehha.ca.gov/air/chronic_rels/ragsii.html

Guillette LJ & Guillette E (1996) Environmental contaminants and reproductive abnormalities in wildlife: Implications for public health? *Toxicol Industrial Health,* 12, 537–550

IL EPA (1997*) Endocrine Disruptors Strategy.* Illinois Environmental Protection Agency, available [January 2005] at http://www.epa.gov/OSA/spc/htm/Endoqs.htm

Keith LH (1997) Environmental endocrine disruptors: An overview of the analytical challenge. *13th Annual Symposium on Waste Testing & Quality Assurance*, July 8th 1997, Alexander, VA, available [February 2002] at http://www.instantref.com/wtqa-ppr.doc

NIOSH (2002) *Registry of Toxic effects of Chemical Substances*. US National Institute for Occupational Safety and Health, available [February 2002] at http://www.cdc.gov/niosh/rtecs/go92dda8.html

US EPA (1997a) *Announcement of the Draft Drinking Water Contaminant Candidate List; Notice 62.* US Environmental Protection Agency. Federal Register, 62, 52193–52219

German Federal Environment Agency

Two reports of relevance produced by the German Federal Environment Agency (Umweltbundesamt, UBA) were identified. *Endocrinically Active Chemicals and Their Occurrence in Surface Waters* (Gülden *et al*., 1998) contains a survey of the scientific literature for synthetic chemicals with oestrogenic, anti-oestrogenic, androgenic and anti-androgenic activity. In 2001, the Agency published *Precautionary Risk Assessment and Risk Management of Chemicals,* which examined the management of chemicals in the environment. Part II of the report, entitled *Chemicals in the Environment Which Interfere with the Endocrine Systems of Humans and Wildlife* (UBA, 2001), presented those chemicals identified in Group I of the BKH report. No additional information to that included in the BKH report was presented.

Institute for Environment and Health

A CD-ROM-based relational database of information on environmental and endocrine disrupting properties of selected chemicals, *Relational Database of Information on Potential Endocrine Disrupter*s (REDIPED), has been developed by IEH (2002). Chemicals in the REDIPED database that were included in the consolidated listing were those for which evidence of endocrine disrupting potential had been identified from published papers involving *in vivo* or *in vitro* testing.

California Environmental Protection Agency

In order to comply with the Safe Drinking Water and Toxic Enforcement Act of 1986, the State of California produces a list of chemicals associated with male or female reproductive toxicity or damage to the unborn foetus that is revised and published on an annual basis. The 2001 listing, *Chemicals Known to the State to Cause Cancer or Reproductive Toxicity, 2001*, used as a source for this report, included approximately 300 pharmaceutical, biocidal or industrial compounds.

Japan Chemical Industry Ecology—Toxicology & Information Center

The Japan Chemical Industry Ecology-Toxicology & Information Center (JETOC) report *A Study on Chemicals Which Affect the Endocrine Systems* (JETOC, 1997) identified approximately 140 compounds suspected of possessing endocrine disrupting properties.

Other sources

Listings of established or potential EDs from other relevant sources, such as publications by scientific societies, were incorporated into the consolidated list. These included publications from the Society of Environmental Toxicology and Chemistry (SETAC) and the Royal Society of Chemistry (RSC) in which individual authors had published lists of potential EDs. Listings of established or potential EDs

compiled by a number of other organisations were identified and included in the consolidated tabulation. These included outputs from the World Wide Fund For Nature Canada (WWF-CAN), Friends of the Earth (FoE), UK Pesticide Action Network (PAN UK), and the *Our Stolen Future* Web site (Colburn *et al*., 1996). Limited mention of these sources is, however, made in the consolidated listings tables presented in this report since the content of many of these was found to be directly derived from other (earlier) sources.

2.2 On-line database searches for published original papers and reviews

As part of an on-going current awareness service for the Department for Environment, Food and Rural Affairs (Defra), IEH has for a number of years undertaken structured monthly searches of on-line databases, to identify original papers and reviews relating to various aspects of the endocrine disruption issue. The search strategy used was intentionally wide-ranging, having been developed to identify published works on general aspects of the endocrine disruption issue, and also on specific aspects such as environmental and human exposure to EDs, effects in wildlife, ED testing and screening methods and results, mechanistic investigations, the effects of phytoestrogens (and mycoestrogens), and changes in male reproductive health. The on-line databases routinely used for the searches are: Medline; Biosis; Embase; NTIS; ToxNet; SciSearch; Pascal; and CA Search.

The output from the monthly searches during the period January 2000 to January 2002 was reviewed to identify additional chemicals for inclusion on the consolidated list.

2.3 Corroboration of chemical property and use information

Following compilation of the consolidated list of chemicals purported to be EDs from the various source reports, lists, databases and individual peer-reviewed papers (see Sections 2.1 and 2.2), rigorous attempts were made to confirm the identity, nomenclature and use of each of the chemicals. Searches were conducted using on-line databases (such as Chemfinder, Merck Index, US Chemical Industry website, and TOXNET). Efforts were also made to check, where possible, the suggested biological effect(s), using on-line databases such as Web of Science, together with more generic searches using the Google internet search engine. Where no corroborating information was identified, or where apparent mistakes or inconsistencies in the data presented in the source document were identified, appropriate comment was made against the relevant chemical in the Notes column of the tabulation (see below).

2.4 Tabulation of results

Following verification of data for individual substances (to the extent possible in an exercise of this nature), information on each substance was reviewed, and it was allocated to one of six categories according to the type of chemical and/or its primary use.

General anthropogenic chemicals

This group comprises man-made chemicals (excluding biocides, pharmaceuticals, consumer products, and inorganic compounds and organo-metallic complexes, which were tabulated separately; see below). These chemicals are used, for example, for industrial purposes (as intermediates), are waste products from the disposal or use of industrial chemicals (e.g. dioxins), or are metabolites or degradation products of industrial chemicals.

Biocides

This grouping comprises the major types of biocide (such as insecticides, herbicides and fungicides) but excludes metal-containing organic compounds (see below).

Biogenic compounds

Substances occurring naturally in the environment that are derived from plants (including lignans, produced by the digestion of plant material) or as fungal metabolites represent biogenic compounds. Natural steroids produced by animals are also included, but owing to the large number of different androgens and oestrogens, only the main steroids of concern are listed in the inventory.

Pharmaceuticals

Prescribed pharmaceutical products (including artificial steroids) are included under this heading.

Inorganic compounds and organo-metallic complexes

This grouping includes halogens, various ions and metals and their organic and salt complexes. These substances are used in a variety of applications ranging from industrial intermediates to preservatives and biocides.

Consumer products

Chemicals with intended direct (but non-medical) human application or exposure, such as food preservatives and cosmetic preparations, are designated consumer products.

Owing to the large number of compounds identified in each of the anthropogenic, biocide and biogenic categories, these were subdivided into smaller groups relating to chemical structure or intended use, as shown in the table below.

Chemical categories and subcategories

General anthropogenic chemicals	Biogenic substances	Biocides and derivatives
Alcohols and glycols	Anthraquinones	Carbamates
Aromatic hydrocarbons	Flavanones	Fungicides
Anilines and derivatives	Isoflavonoid compounds	Herbicides
Benzene and derivatives	Lignans	Organochlorines
Benzophenones and derivatives	Phenolic acids	Organophosphates
Biphenyls and metabolites	Plant-derived substances	Pyrethroids
Dioxins and metabolites	Vitamins	Miscellaneous
Diphenyl derivatives	Miscellaneous	
Diphenyl ethers		
Furans and metabolites		
Naphthols and naphthalenes		
Phenols and derivatives		
Phthalate esters and derivatives		
Siloxanes		
Styrene and derivatives		
Miscellaneous		

Chemicals in the pharmaceutical, inorganic/organo-metallic and consumer product categories were tabulated in alphabetical order.

2.5 Frequency of citation

The number of sources identifying each compound as a putative ED was noted.

3 Results

3.1 Numbers of chemicals identified

A total of 966 compounds or elements were identified as having been suggested to be established or potential endocrine disrupters (EDs).

The largest group are the general anthropogenic chemicals, consisting of 539 individual chemicals, metabolites or degradation products. The second largest category constitutes the biocides and includes 225 chemicals, metabolites or degradation products. The third category comprises 62 chemicals of natural (biogenic) origin that have been suggested as having hormonal activity. The other categories are: pharmaceuticals (58 substances); inorganics and organo-metallic complexes (54) and consumer products (28).

The quality of information presented in the source documents or databases is quite variable. In some instances, the information on the identity of a particular compound, either in terms of scientific or trade name or CAS Number, could not be verified, and sometimes a particular chemical entity was repeated in a listing under various different synonyms. In addition, in some instances the basis for inclusion as a putative ED was either not stated in the source document or could not be confirmed. Thus, despite strenuous efforts to ensure that the information presented is accurate, **inclusion in the following tabulation cannot be taken to imply that IEH or Defra agrees with the classification of the compound as an established or potential ED**. This highlights the need for caution when consulting such sources and the importance of referring to primary data sources when seeking to review the available evidence for a particular chemical.

3.2 Frequency of citation

Consideration of the number of sources identifying a particular chemical as an ED showed that the majority of the compounds in the anthropogenic, biogenic, inorganic/organo-metallic, pharmaceutical or consumer product categories were each cited in only one source document. In contrast, the majority of biocidal products had each been cited as a putative ED by three or four sources.

3.3 Content of tables

In Tables 1–6, five columns are presented. The nature of the information in each column is described in the following paragraphs. An explanation of the acronyms used is also provided.

Chemical name

The first column gives the common chemical name for the compound. Where identification has not been corroborated from a second source, the name as used by the source is presented.

CAS number

Each CAS Registry number is a unique numeric identifier that designates a specific chemical. Where a CAS number was not identified in the source or from searches of on-line databases, ‘Not available’ (NA) is indicated.

Chemical group and/or use

The chemical group and/or family to which the compound belongs and its major use or primary source are indicated. Where it was not possible to identify the compound use or source, NA is indicated. The use/source category provides an indication of the likelihood of exposure, for example chemical intermediates are unlikely to enter the environment in sufficient quantities to raise cause for concern.

Reference source

The source reference(s) that identified the compound as an established or potential ED is presented. The full citation for each paper is detailed in References, at the end of the report.

Notes

This column identifies the cause for concern for each compound. Causes of concern include effects such as disturbance of hormonal homeostasis, hormone-recepter binding ability, recepter agonistic or antagonistic activity, or reproductive effects. Although the latter are not necessarily attributable to endocrine disruptive mechanisms, many reproductive toxicants are cited in the source lists solely on this basis. Where appropriate, the group categorisation assigned in the EC-BKH (2000) report is also presented.

- Group I, evidence of endocrine disruption; high exposure concern.
- Group II, evidence of potential endocrine disruption; medium exposure concern.
- Group III, no evidence of endocrine disruption; low exposure concern.

The Notes column also highlights uncertainties identified with regard to the information presented in the source list or paper. For example, where a chemical name or CAS number could not be corroborated, the term ‘Identification unconfirmed' is included against the relevant chemical in the Notes column. Similarly, comment is made where other apparent mistakes or inconsistencies were identified in the source.

Acronyms used

AGD	anogenital distance	OP	organophosphate
AR	androgen recepter	PAH	polyaromatic hydrocarbon
CB	chlorinated biphenyl	PBB	polybrominated biphenyl
CFC	chlorofluorocarbon	PCB	polychlorinated biphenyl
CNS	central nervous system	POP	persistent organic pollutant
CYP450	cytochrome P450 enzymes	PR	progesterone recepter
ER	oestrogen recepter	SHBG	sex hormone binding globulin
FSH	follicle stimulating hormone	T	testosterone
HAA	hormonally active agent	T3	tri-iodothyronine
HRT	hormone replacement therapy	T4	thyroxine
hTTR	human transthyretin	TPO	thyroid peroxidase
LH	luteinising hormone	TRH	thyrotrophin releasing hormone
NA	not available	UV	ultraviolet
OC	organochlorine	VTG	vitellogenin

Table 1 General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
PHENOLIC COMPOUNDS & DERIVATIVES				
1,1-bis(4-hydroxyphenyl)-1-(4-methoxyphenyl)ethane	115489-12-8	Use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl)-1-phenylethane	1571-75-1	Use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl)-2-ethyl-n-butane	92569-29-4	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl)-2-n-propylpentane	NA	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl)ethane [Bisphenol E]	2081-08-5	Alkylphenol; use unknown	Perez *et al.,* 1998; EC-BKH	*In vitro* oestrogenic activity; Group III
1,1-bis(4-hydroxyphenyl) -iso-butane	1844-00-4	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl) -isopentane	2081-32-5	Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl) -n-butane	4731-84-4	Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl) -n-heptane	3373-03-03	Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
1,1-bis(4-hydroxyphenyl) -propane	1576-13-2	Bisphenol A derivative	Perez *et al.,* 1998; EC-BKH	*In vitro* oestrogenic activity; Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
1,1-dichloro, 2,2-bis (4-hydroxy) ethylene [bis-OH-MDDE]	14868-03-2	Novel bisphenol	EC-BKH	Group III
1,3-bis(4-hydroxyphenyl)pentane	4865-83-2	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
1,3-bis(4-hydroxyphenyl)propane	2549-50-0	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
1-methylheptyl phenol	27985-70-2	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
1-(p-hydroxyphenyl)octane	1806-26-4	Use unknown	SC	NA
2-methylresorcinol	608-25-3	Present in coal and shale	Lindsay *et al.,* 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
2-(nonylphenoxy)-ethanol	27986-36-3	Surfactant; industrial & pharmaceutical uses	EC-BKH	Group III
2-(octylphenoxy) ethanol	1322-97-0	Use unknown	EC-BKH	Group III Identification unconfirmed
2,2,5,5-tetra(4-hydroxyphenyl)-n-hexane	7615-24-9	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,2,6,6-tetramethyl-4,4-bis-(4-hydroxyphenyl)-n-heptane	NA	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,2-bis(2-(2,3-epoxypropoxy)-phenyl)-propane	25036-25-3	Bisphenol A diglycidyl ether; epoxy resin	EC-BKH	Group III Identification unconfirmed
2,2-bis(4-hydroxy-3-methylphenyl)-propane	79-97-0	Bisphenol A derivative	Perez et al., 1998; Nishihara et al., 2000	In vitro oestrogenic activity
2,2-bis(4-hydroxyphenyl)-3-methyl-n-butane	3555-19-9	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,2-bis(4-hydroxyphenyl)-4-methyl-n-pentane	6807-17-6	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
2,2-bis(4-hydroxyphenyl)butane [Bisphenol B]	77-40-7	Phenol; production of phenol resins	Perez *et al.,* 1998; Nishihara *et al.,* 2000; Blair *et al.,* 2000 EC-BKH	*In vitro* agonist ER activity *In vitro* ER binding affinity Group III
2,2-bis(4-hydroxyphenyl)-n-heptane	41709-94-8	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,2-bis(4-hydroxyphenyl)-n-hexane	14007-30-8	Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
2,2-bis(4-hydroxyphenyl)-n-octane	6052-90-0	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,2-bis(4-hydroxyphenyl)-n-pentane	4204-58-4	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,2-bis(4-hydroxyphenyl)-perfluoropropane	NA	Bisphenol A derivative	Perez *et al.,* 1998	*In vitro* oestrogenic activity
2,2-bis(4-hydroxyphenyl)-propanol	NA	Bisphenol A derivative	Perez *et al.,* 1998	*In vitro* oestrogenic activity
2,2'-dihydroxybiphenyl	1806-29-7	Phenol; use unknown	EC-BKH	Group III
2,4-bis(4-hydroxyphenyl)-3-ethylhexane	85-95-0	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,4-bis(4-hydroxyphenyl)-3-ethylpentane	NA	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
2,4-dichlorophenol	120-83-2	Pesticide intermediate	SC; IEH EC-BKH	Immunological dysfunction Group II
2-benzylphenol	28994-41-4	Phenol derivative; germicide; antiseptic & preservative	EC-BKH	Group III
2-bromo-4-(2,4,6-tribromophenoxy)phenol	NA	Flame retardant	Meerts *et al.,* 2001	*In vitro* agonist ER activity
2-chloro-4-methylphenol	6640-27-3	Chlorinated alkylphenol	Blair *et al.,* 2000	*In vitro* ER binding affinity
2-ethylphenol	1331-54-0	Use unknown	EC-BKH	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
2-octylphenol	949-13-3	Phenol; use unknown	EC-BKH	Group III
3,3-bis(4-hydroxyphenyl)-n-hexane	10196-77-7	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
3,3-bis(4-hydroxyphenyl) pentane	3600-64-4	Phenol derivative; use unknown	Perez *et al.,* 1998 EC-BKH	*In vitro* oestrogenic activity Group III
3,5-bis(4-hydroxyphenyl) heptane	140131-31-3	Phenol derivative: use unknown	EC-BKH	Group III Identification unconfirmed
4,4-bis(4-hydroxyphenyl) heptane	7425-79-8	Bisphenol A derivative	Perez *et al.,* 1998 EC-BKH	*In vitro* oestrogenic activity Group III
4,4-bis(4-hydroxyphenyl) -n-octane	NA	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
4,4'-dihydroxybiphenol	NA	Use unknown	Nishihara *et al.,* 2000	*In vitro* agonist ER activity
4,4'-dihydroxybiphenyl	92-88-6	Phenol additive; antioxidant	SC Miller *et al.,* 2001 EC-BKH	Thyroid disrupter *In vitro* ER activity Group III
4-(4-hydroxyphenyl)-2,2,6,6-tetramethylcyclohexanecarbon acid	53792-11-3	Use unknown	EC-BKH	Group III Identification unconfirmed
4,4'-methylenediphenol [Bisphenol F]	620-99-8	Alkylphenol; antioxidant & industrial use	Colburn; Rudel *et al.,* 2001 Miller *et al.,* 2001 Perez *et al.,* 1998; Nishihara *et al.,* 2000; Blair *et al.,* 2000 EC-BKH	*In vitro* ER binding affinity HAA *In vitro* ER activity *In vitro* oestrogenic binding affinity Group III
4,4'-sulfonyldiphenol [Bisphenol S]	80-09-1	Phenol; industrial intermediate	Blair *et al.,* 2000	*In vitro* ER binding affinity
4-benzylphenol	101-53-1	Use unknown	Schultz *et al.,* 2000b EC-BKH	*In vitro* agonist ER activity Group III
4-chloro-2-isopropyl-5-methyl -phenol	NA	Industrial use	Kramer & Giesy, 1999	ER binding

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
4-chloro-2-methylphenol	1570-64-5	Alkylphenol compound	Blair *et al.,* 2000; EC-BKH	*In vitro* ER binding affinity; Group II
4-chloro-3-methylphenol	59-50-7	Phenol additive; disinfectant	Miller *et al.,* 2001; Nishihara *et al.,* 2000; IEH EC-BKH	*In vitro* agonist ER activity; Group II
4-ethylphenol	123-07-9	Phenol; used in the flavours/ fragrance industry	Blair *et al.,* 2000 Nishihara *et al.,* 2000	*In vitro* oestrogenic binding affinity *In vitro* agonist ER activity
4-heptyloxyphenol	13037-86-0	Phenol; use unknown	Blair *et al.,* 2000 Schultz *et al.,* 2000b	*In vitro* ER binding affinity *In vitro* agonist ER activity
4-hydroxy alkylphenol		Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
4-hydroxyphenyl-4'-methoxyphenylmethane	21388-77-2	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
4-isooctylphenol	27013-89-4	Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
4-iso-pentylphenol	1805-61-4	Alkylphenol; use unknown	EC-BKH	Group III Identification unconfirmed
4-n-butylphenol	1638-22-8	Phenol; use unknown	Nishihara *et al.,* 2000	*In vitro* agonist ER activity
4-n-hexylphenol	2446-69-7	Phenol; use unknown	JETOC Nishihara *et al.,* 2000	NA *In vitro* agonist ER activity
4-nonylphenol	104-40-5	Phenol; non-ionic surfactant	EC-BKH OSPAR; SC	Group III
4-nonylphenol diethoxylate	20427-84-3	Nonylphenol polyethoxylate degradation product	JETOC EC-BKH	NA Group III
4-nonylphenol polyethoxylate	NA	Phenol; surfactant	Nishihara *et al.,* 2000	*In vitro* ER agonist
4-nonylphenol nonaethoxylate	14409-72-4	Use unknown	EC-BKH	Group III Identification unconfirmed
4-pentylphenol	14938-35-3	Intermediates in pesticide production	JETOC Nishihara *et al.,* 2000; Schultz *et al.,* 2000b	NA *In vitro* ER agonist

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
4-phenethylphenol	6335-83-7	Diphenyl derivative; use unknown	Blair *et al.,* 2000	*In vitro* ER binding affinity
4-phenoxyphenol	831-82-3	Flame retardant	Meerts *et al.,* 2001; Schultz *et al.,* 2000b	*In vitro* ER agonist
4-phenylphenol	92-69-3	Diphenyl derivative; industrial intermediate	Blair *et al.,* 2000; Miller *et al.,* 2001; Nishihara *et al.,* 2000 EC-BKH JETOC	 *In vitro* ER binding affinity *In vitro* ER agonist Group III NA
4-propoxyphenol	18979-50-5	Phenol; use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
4-propylphenol	645-56-7	Phenol; use unknown	JETOC; Schultz *et al.,* 2000b; Nishihara *et al.,* 2000	NA *In vitro* ER agonist
4-sec-butylphenol	99-71-8	Phenol; use unknown	Rudel *et al.,* 2001; Nishihara *et al.,* 2000; EC-BKH	*In vitro* ER agonist Group III
4-sec-octylphenol	27214-47-7	Use unknown	EC-BKH	Group III Identification unconfirmed
4-sec-pentylphenol	25735-67-5	Phenol	EC-BKH	Group III
4-tert-octylphenol	140-66-9	Alkylphenol; surfactant	SC; IEH; OSPAR EC-BKH	Oestrogenic activity Group II & III
5-methylresorcinol	504-15-4	Present in coal and shale	Lindsay *et al.,* 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
5,5-bis(4-hydroxyphenyl)-n-nonane	57547-76-9	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
6,6-bis(4-hydroxyphenyl)-n-undekane	59176-75-9	Phenol derivative: use unknown	EC-BKH	Group III Identification unconfirmed
bis(3-hydroxyphenyl)methane	10193-50-7	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
bis(4-hydroxyphenyl) ketone	NA	Bisphenol A derivative	Perez *et al.,* 1998	*In vitro* oestrogenic activity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
bis(4-hydroxyphenyl) phenylmethane	4081-02-1	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
bisphenol A	80-05-7	Phenol; production of epoxy resins	Colburn IEH OSPAR; UBA; SC EC-BKH	*In vitro* ER binding affinity Oestrogenic activity Group I
bisphenol A bischloroformate	2024-88-6	Phenol; production of plastics, resins	Perez *et al.,* 1998	*In vitro* oestrogenic activity
bisphenol A dimethacrylate	3253-39-2	Phenol; production of plastics, resins	Perez *et al.,* 1998	*In vitro* oestrogenic activity
bisphenol A ethoxylate diacrylate	64401-02-1	Phenol; production of plastics, resins	Perez *et al.,* 1998	*In vitro* oestrogenic activity
bisphenol A-(epichlorhydrin) metacrylatepolymer	36425-15-7	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
bisphenol A, epichlorohydrin polymer	25068-38-6	Epoxy resin	EC-BKH	Group III
bisphenol A-diglycidyl ether polymer	25085-99-8	Bisphenol A diglycidyl ether; epoxy resin	EC-BKH	Group III
butylphenol (4-tert-)	98-54-4	Phenol additive; varnish; resin & anti-oxidant	JETOC; OSPAR Miller *et al.,* 2001; IEH EC-BKH	NA *In vitro* ER activity Group II
cresol-bisphenol-A formaldehyde polymer	NA	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
dehydrated castor oil polymer with bisphenol A of epichlorhydrine	66070-77-7	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
dibromobisphenol A	NA	Brominated analogue of BPA; fire retardant	Samuelsen *et al.,* 2001 Meerts *et al.,* 2001	*In vitro* MCF-7 cellproliferation *In vitro* ER activity
dichlorophenol	25167-81-1	NA	EC-BKH	Group III
diglycidyl ether of bisphenol A	1675-54-3	Phenol; use in resins & adhesives	EC-BKH IEH	Group II

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
dinitrophenol	25550-58-7	Phenol; manufacture of dyes & wood preservatives	SC; WWF-CAN EC-BKH	NA Group III
epichlorhydrin-bisphenol A/F reaction products	98824-88-5	Phenol derivative; use unknown	EC-BKH	Group III
ferulic acid [(E)-isomer]	537-98-4	Phenol acid; antioxidant	EC-BKH	Group III
heptylphenol	1987-50-4	Phenol; use unknown	JETOC	NA
hydroquinone	123-31-9	Present in coal and shale	Lindsay *et al.,* 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
hydroxyhydroquinone	533-73-3	Phenol derivative; use unknown	EC-BKH	Group III
monobromobisphenol A	NA	Brominated analogue of BPA; fire retardant	Samuelsen *et al.,* 2001 Meerts *et al.,* 2001	*In vitro* MCF-7 cell proliferation *In vitro* ER activity
nonylphenol	25154-52-3	Phenol (mixed isomers); surfactant & resin additive	IEH; Colburn; EC-BKH	Oestrogenic/androgenic activity Group II
nonylphenol (4-tert)	84852-153	Alkylphenol; surfactant	IEH	Oestrogenic agonism
nonylphenolethyleneoxy-phosphate	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
nonylphenolcarboxylic acid	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
nonylphenolethoxylate carboxylic acid	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
octylphenol [tetramethylbutyl phenol]	27193-28-8	Phenol; use unknown	EC-BKH	Group III
octylphenol	67554-50-1	Phenol; inert pesticide ingredient	Colburn EC-BKH	Oestrogenic/androgenic activity Group III
octylphenol-5-ethoxylate	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
p-cyclohexylphenol	1131-60-8	Phenol; used in resin formation	EC-BKH	Group III
pentylphenol	87-26-3	Phenol; pesticide intermediate	JETOC EC-BKH	NA Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
phenol	108-95-2	Phenol; manufacture of drugs, pesticides & resins	JETOC; WWF-CAN	NA
phenol red	143-74-8	Phenol; reagent	Blair *et al.,* 2000	*In vitro* ER binding affinity
phenol, 2-(1,1,3,3-tetramethylbutyl)-	3884-95-5	Phenol; use unknown	EC-BKH	Group III
phenol, 2-(1-ethylhexyl)	17404-44-3	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
phenol, 2-(1-methylheptyl)-	18626-98-7	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
phenol, 2-(1-propylpentyl)-	37631-10-0	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
phenol, 4-(1ethylhexyl)-	3307-00-4	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
phenol, 4-(1-methyl heptyl)	1818-08-2	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
4-hexyloxyphenol	18979-55-0	Use unknown	JETOC; Schultz *et al.,* 2000b	*In vitro* ER agonist
4-cyclopentylphenol	1518-83-8	Use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
4-(imidazol-1-yl) phenol	10041-02-8	Use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
4-n-pentyloxyphenol	18979-53-8	Use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
3,4-dichlorophenol	95-77-2	Use unknown	Nishihara *et al.,* 2000	*In vitro* ER agonist
iso-octylphenol	11081-15-5	Phenol; use unknown	EC-BKH	Group III
4-(1-adamantyl) phenol	29799-07-3	Use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
benzyl-4-hydroxyphenyl ketone	2491-32-9	Use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
4-benzyloxyphenol	103-16-2	Use unknown	Schultz *et al.,* 2000b Blair *et al.,* 2000	*In vitro* ER agonist *In vitro* ER binding affinity
phenol, 4(1-propylpentyl)-	3307-01-5	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
phenolphthalin	81-90-3	Phenol; reagent	Blair *et al.,* 2000	*In vitro* ER binding affinity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
phenylphenol (2-hydroxybiphenyl)	90-43-7	Phenol; industrial intermediate, preservative, disinfectant & fungicide	Rudel *et al.,* 2001 Miller *et al.,* 2001 EC-BKH IEH	HAA *In vitro* ER agonist Group II
poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-forgrenet	51811-79-1	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
polymerised bisphenol-A, butylglydiocylether, epichlorhydrine	105839-18-7	Phenol derivative; use unknown	EC-BKH	Group III Identification unconfirmed
p-vinylphenol	2628-17-3	Phenol;used in cosmetics/fragrance	EC-BKH	Group III
tergitol [nonylphenol polyethylene glycol ether]	3282-85-7	Non-ionic surfactant	JETOC	NA
tetrabromobisphenol A	79-94-7	Brominated fire retardant	EC-BKH	Group III
2-sec-octylphenol	26401-75-2	Use unknown	EC-BKH	Group III Identification unconfirmed
4-chlorophenol	106-48-9	Industrial/pesticide intermediate & antiseptic	Nishihara *et al.,* 2000	*In vitro* agonist ER activity
4-dodecylphenol	104-43-8	Surfactant intermediate	JETOC	NA
sec-octylphenol	93891-78-2	Use unknown	EC-BKH	Group III Identification unconfirmed
PHTHALATE ESTERS & DERIVATIVES				
bis(2-ethylhexyl)adipate	103-23-1	Production of plastics, resins	JETOC EC-BKH	NA Group III
bis(2-ethylhexyl)phthalate [DEHP]	117-81-7	Production of plastics, resins	Colburn; IEH SC ; UBA; OSPAR EC-BKH	ER & androgenic antagonism Decrease in fertility Group I

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
butylbenzyl phthalate [BBP]	85-68-7	Phthalate	UBA; SC Colburn; IEH; OSPAR EC-BKH	Oestrogenic activity ER antagonist Group I
dibutyl phthalate [DBP]	84-74-2	Phthalate ester	UBA; IEH; SC; OSPAR Colburn EC-BKH	Oestrogenic activity; increases FSH ER and androgenic antagonism Group I
dicyclohexyl phthalate	84-61-7	Phthalate ester	SC EC-BKH	Group III
diethyl phthalate	84-66-2	Phthalate	Colburn; SC Rudel *et al.*, 2001; EC-BKH	Oestrogenic disrupter HAA Group III
di-isobutyl phthalate	84-69-5	Phthalate	Rudel *et al.*, 2001; WWF-CAN EC-BKH	HAA Group III
di-isodecyl phthalate	26761-40-0; 68515-49-1	Phthalate; use unknown	EC-BKH IEH	Group II
di-isononyl phthalate [DINP]	28553-12-0	Phthalate ester; elasticiser	IEH EC-BKH	*In vitro* oestrogen agonist Group II
di-n-hexylphthalate	84-75-3	Phthalate	SC EC-BKH	NA Group III
di-n-octyl phthalate	117-84-0	Phthalate ester	SC EC-BKH	Teratogen: eye & ear; Group III
dipentyl phthalate	131-18-0	Phthalate ester	SC EC-BKH	Oestrogenic activity Group III
dipropyl phthalate	131-16-8	Phthalate ester	Nishihara *et al.*, 2000; SC EC-BKH	*In vitro* agonist ER activity Group III
monobutyl phthalate	131-70-4	Phthalate; use unknown	EC-BKH	Group III
monoethylhexyl phthalate	4376-20-9	Phthalate; use unknown	EC-BKH	Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
FURANS & METABOLITES				
1,2,3,4,6,7,8,9-octachlorodibenzofuran	39001-02-0	Furan	SC	NA
1,2,3,7,8-pentabromodibenzofuran	107555-93-1	Industrial chemical	EC-BKH UBA	Group III
1,2,3,7,8-pentachlorodibenzofuran	57117-41-6	Furan	EC-BKH	Group II
1,2,3,7,9-pentachlorodibenzofuran	83704-53-4	Furan	Colburn EC-BKH	ER antagonism Group II
1,2,7,8-tetrachlorodibenzofuran	58802-20-3	Furan	EC-BKH	Group II
1,3,6,8-tetrachlorodibenzofuran	71998-72-6	Furan	Colburn EC-BKH	ER antagonism Group II
2,3,4,7,8-pentachlorodibenzofuran	57117-31-4	Furan	Colburn EC-BKH	ER antagonism Group I
2,3,7,8-tetrabromodibenzofuran	67733-57-7	Furan	EC-BKH	Group II
2,3,7,8-tetrachlorodibenzofuran	51207-31-9	Waste product of combustion	SC; Colburn; WWF-CAN; UBA	Thyroid disrupter; oestrogen antagonism
3,8-dihydroxy-2-chlorodibenzofuran	NA	Use unknown	Nishihara *et al.,* 2000	*In vitro* agonist ER activity
7-hydroxy-3,4-dichlorodibenzofuran	NA	Use unknown	Nishihara *et al.,* 2000	*In vitro* agonist ER activity
6-ethyl-1,3,8-trichlorodibenzofuran	125652-16-6	Furan	EC-BKH	Group III Identification unconfirmed
6-i-propyl-1,3,8-trichlorodibenzofuran	125652-13-3	Furan	EC-BKH	Group III Identification unconfirmed
6-methyl-1,3,8-trichlorodibenzofuran	118174-38-2	Furan	EC-BKH	Group III Identification unconfirmed
6-methyl-2,3,4,8-tetrachlorodibenzofuran	139883-51-5	Furan	EC-BKH	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
6-methyl-2,3,8-trichlorodibenzofuran	172485-97-1	Furan	EC-BKH	Group III Identification unconfirmed
6-n-propyl-1,3,8-trichlorodibenzofuran	125652-14-4	Furan	EC-BKH	Group III Identification unconfirmed
6-t-butyl-1,3,8-trichlorodibenzofuran	125652-12-2	Furan	EC-BKH	Group III Identification unconfirmed
8-bromo-2,3,4-trichlorodibenzofuran	103124-72-7	Furan	EC-BKH	Group III Identification unconfirmed
8-hydroxy-2,3,4-trichlorodibenzofuran	NA	Furan metabolite	Nishihara *et al.*, 2000	*In vitro* ER agonist
8-hydroxy-2-monochlorodibenzofuran	NA	Furan metabolite	Nishihara *et al.*, 2000	*In vitro* ER agonist
8-hydroxy-3,4,6-trichlorodibenzofuran	NA	Furan metabolite	Nishihara *et al.*, 2000	*In vitro* ER agonist
8-hydroxy-3,4-trichlorodibenzofuran	NA	Furan metabolite	Nishihara *et al.*, 2000	*In vitro* ER agonist
8-hydroxy-3-monochlorodibenzofuran	NA	Furan metabolite	Nishihara *et al.*, 2000	*In vitro* ER agonist
8-methyl-1,2,4,7-tetrachlorodibenzofuran	139883-50-4	Furan	EC-BKH	Group III Identification unconfirmed
8-methyl-1,3,6-trichlorodibenzofuran	172485-96-0	Furan	EC-BKH	Group III Identification unconfirmed
8-methyl-1,3,7-trichlorodibenzofuran	172485-98-2	Furan	EC-BKH	Group III Identification unconfirmed
8-methyl-2,3,4,7-tetrachlorodibenzofuran	172486-00-9	Furan	EC-BKH	Group III Identification unconfirmed
8-methyl-2,3,7-trichlorodibenzofuran	172485-99-3	Furan	EC-BKH	Group III Identification unconfirmed
dibenzofurans (chlorinated), 1080	42934-53-2	Waste product of combustion	SC	Thyroid dysfunction

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
tetrabromodibenzofuran	106340-44-7	Furan	EC-BKH	Group II
tetrahydrofuran	109-99-9	Furan	SC	NA
DIOXINS & METABOLITES				
1,2,3,4,6,7,8-heptachlorodibenzo-p-dioxin	3582246-9	Dioxin	SC	NA
1,2,3,6,7,8-hexachlorodibenzodioxin	57653-85-7	Dioxin	IEH	NA
1,2,3,7,8,9-heptachlorodibenzo-p-dioxin	19408-74-3	Dioxin	SC	NA
1,2,3,7,8-pentabromodibenzodioxin	109333-34-8	Dioxin	EC-BKH	Group III
1,2,3,7,8-pentochlorodibenzodioxin	40321-76-4	Industrial chemical	EC-BKH UBA	Group I
1,2,4,7,8-pentachlorodibenzodioxin	NA	Dioxin	EC-BKH	Group III Identification unconfirmed
1,3,7,8-tetrachlorodibenzo-p-dioxin	50585-46-1	Dioxin	EC-BKH	Group III
2,3,7,8- tetrachlorodibenzo-p-dioxin [TCDD]	1746-01-6	Dioxin: waste product of combustion	SC; IEH Colburn EC-BKH	Decreases T synthesis Oestrogen antagonism Group I
2,3,7,8-tetrabromodibenzodioxin	50585-41-6	Dioxin	EC-BKH	Group III
2,3-dibromo-7,8-dichlorodibenzodioxin	50585-40-5	Dioxin	EC-BKH	Group III Identification unconfirmed
2,8-dibromo-3,7-dichlorodibenzodioxin	109333-32-6	Dioxin	EC-BKH	Group III Identification unconfirmed
2-bromo-1,3,7,8-tetrachlorodibenzodioxin	131167-13-0	Dioxin	EC-BKH	Group III Identification unconfirmed
2-bromo-3,7,8-trichlorodibenzodioxin	NA	Dioxin	EC-BKH	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
7-bromo-2,3-dichlorodibenzodioxin	97741-74-7	Dioxin	EC-BKH	Group III Identification unconfirmed
8-methyl-2,3,7-trichlorodibenzodioxin	112344-57-7	Dioxin	EC-BKH	Group III Identification unconfirmed
tetrabromodibenzodioxin	103456-39-9	Dioxin	EC-BKH	Group III
BIPHENYLS & METABOLITES				
2,3,3',4,5-pentachlorobiphenyl [PCB 122]	76842-07-4	PCB	Colburn EC-BKH	Reproductive disrupter Group III Identification unconfirmed
2,3,4,4',5-pentachlorobiphenyl [PCB 114]	74472-37-0	PCB	EC-BKH	Group III Identification unconfirmed
2,2',3,3',4,4'-hexachlorobiphenyl [PCB128]	38380-07-3	PCB	EC-BKH	Group III
2,2',3,3',6,6'-hexachlorobiphenyl [PCB 136]	38411-22-2	PCB	EC-BKH	Group II
2,2',3,4,4',5,5'-heptachlorobiphenyl [PCB 180]	35065-29-3	PCB	EC-BKH	Group III
2,2',3,4,4',5'-hexachlorobiphenyl [PCB 138]	35065-28-2	PCB	EC-BKH	Group III
2,2',3,4',5',6-hexachlorobiphenyl [PCB 149]	38380-04-0	PCB	Li *et al.,* 2001	*In vivo* thyroxine disrupter
2,2',3,5',6-pentachlorobiphenyl [PCB 95]	38379-99-6	PCB	Rogers & Denison, 2000	*In vitro* oestrogenic activity
2,2',4,4',5,5'-hexabromobiphenyl	59080-40-9	PBB; fire retardant	Akoso *et al.,* 1982 IEH	Thyroid disrupter
2,2',4,4',5,5'-hexachlorobiphenyl [PCB 153]	35065-27-1	PCB	EC-BKH Wojtowicz *et al.,* 2000; UBA	Group I Affects ovarian steroidogenesis *in vitro*
2,2',4,4'-tetrachlorobiphenyl (PCB 47)	2437-79-8	PCB	EC-BKH UBA	Group I

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
2,2',4,5-tetrachlorobiphenyl [PCB 48]	70362-47-9	PCB	EC-BKH	Group II
2,2',4,6,6'-pentachlorobiphenyl [PCB 104]	56558-16-8	PCB	EC-BKH	Group III Identification unconfirmed
2,2',5,5'-tetrachlorobiphenyl [PCB 52]	35693-99-3	PCB	EC-BKH	Group III
2,2',5-trichlorobiphenyl [PCB 18]	37680-65-2	CB	EC-BKH	Group III
2,2'-dichlorobiphenyl [PCB 4]	13029-08-8	CB	EC-BKH	Group III
2,3,3',4,4',5-hexachlorobiphenyl [PCB 156]	38380-08-4	PCB	EC-BKH Colburn	Group II Reproductive disrupter
2,3,3',4,4'-pentachlorobiphenyl [PCB 105]	32598-14-4	PCB	Colburn EC-BKH	Reproductive disrupter Group III
2,3',4,4',5,5'-hexabromobiphenyl [PBB 167]	NA	PBB; fire retardant	Akoso *et al.,* 1982	Thyroid disrupter
2,3',4,4',5-pentachlorobiphenyl [PCB 118]	31508-00-6	PCB	Colburn EC-BKH	Reproductive disrupter Group III
2,3',4,4'-tetrachlorobiphenyl [PCB 66]	52663-58-8	PCB	Rogers & Denison, 2000	*In vitro* oestrogenic activity
2,3,4,5-tetrachlorobiphenyl [PCB 61]	33284-53-6	PCB	EC-BKH IEH	Group II
2,3,4-trichlorobiphenyl [PCB 21]	55702-46-0	CB	EC-BKH; WWF-CAN	Group III
2,4,4',6-tetrachlorobiphenyl [PCB 75]	32598-12-2	PCB	EC-BKH	Group II
2,4,4'-trichlorobiphenyl [PCB 28]	7012-37-5	PCB	EC-BKH	Group III
2,4,6-trichlorobiphenyl	35693-92-6	Industrial chemical	Kramer & Giesy, 1999 EC-BKH	ER binding affinity Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
2,4'-dichlorobiphenyl	34883-43-7	PCB	Blair *et al.*, 2000 EC-BKH	*In vitro* ER binding affinity Group III
2',5'-dichloro-4-biphenylol	53905-28-5	PCB metabolite	Blair *et al.*, 2000; WWF-CAN EC-BKH	*In vitro* ER binding affinity Group III
2,5-dichlorobiphenyl	34883-39-1	Chlorinated biphenyl	EC-BKH	Group III
2-chloro-4-biphenylol	NA	PCB metabolite	Blair *et al.*, 2000	*In vitro* ER binding affinity
2-chlorobiphenyl [PCB 1]	2051-60-7	CB	EC-BKH	Group III
2-hydroxy-2',3,3',4,4'-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-2',5'-dichlorobiphenyl	53905-30-9	PCB metabolite	EC-BKH WWF-CAN	Group III Identification unconfirmed
2-hydroxy-3,3',4',5',6'-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-3,3',6'-trichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-3',4',5,5',6'-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-3',5,6'-trichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-3',5'-dichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-3,5-dichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-3-chlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
2-hydroxy-5-chlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3-biphenylol	NA	NA	Rudel *et al.*, 2001	HAA
3,3',4,4',5,5'-hexabromobiphenyl [PBB 169b]	NA	PBB; fire retardant	Akoso *et al.*, 1982	Thyroid disrupter
3,3',4,4',5,5'-hexachlorobiphenyl [PCB 169]	32774-16-6	PCB	Colburn; UBA EC-BKH	*In vitro* ER binding affinity Group I

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
3,3',4,4',5-Pentachlorobiphenyl [PCB 126]	57465-28-8	PCB	Wojtowicz *et al.*, 2000	Affects ovarian steroidogenesis *in vitro*
			EC-BKH	Group III
3,3',4,4'-tetrachlorobiphenyl [PCB 77]	32598-13-3	Coplanar PCB	Colburn Bowen *et al.*, 2000 UBA; SC	*In vitro* AR binding affinity Thyroid hormone disrupter
			EC-BKH	Group I
3,3',5,5'-tetrachloro-4,4'-biphenyldiol	13049-13-3	PCB metabolite	Blair *et al.*, 2000	*In vitro* ER binding affinity
			EC-BKH	Group III
3,3'-dichlorobiphenyl [PCB 11]	2050-67-1	CB	EC-BKH	Group III
3,4',5-trichlorobiphenyl [PCB 39]	38444-88-1	CB	EC-BKH	Group III Identification unconfirmed
3,5-dichloro-biphenyl	34883-41-5	CB	EC-BKH	Group III
3,5'-dihydroxy-4,4'-dichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3-chlorobiphenyl [PCB 2]	2051-61-8	CB	EC-BKH	Group III
3-hydroxy-2,3',4,4',5-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3-hydroxy-2',3',4,4',5-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3-hydroxy-2',3',4',5'-tetrachlorobiphenyl	67651-37-0	PCB metabolite	Kramer & Giesy, 1999 WWF-CAN	*In vitro* ER binding affinity
			EC-BKH	Group III
3-hydroxy-2',5'-dichlorobiphenyl	53905-29-6	PCB metabolite	EC-BKH	Group III Identification unconfirmed
3-hydroxy-3',5'-dichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3-hydroxy-4,4'dichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3-hydroxy-6-chlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
3'-methyl-4-dimethylaminoazobenzene	55-80-1	Azo dye	SC	NA

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
3-methylsulfonyl-2,2',3',4',5,5'-hexachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
3-methylsulfonyl-2,2',3',4',5,6-hexachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
3-methylsulfonyl-2,2',3',4',5-pentachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
3-methylsulfonyl-2,2',4',5,5',6-hexachlorobiphenyl	NA	Metabolite of chlorinated biphenyl	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
3-methylsulfonyl-2,2',4',5,5'-pentachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
3-methylsulfonyl-2,2',4',5-tetrachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
3-methylsulfonyl-2,3',4',5-tetrachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.*, 2000	*In vivo* thyroid hormone disrupter
4,4'-dichlorobiphenyl [PCB 15]	2050-68-2	CB	EC-BKH	Group III
4,4'-dihydroxy-2,3,5,6-tetrachlorobiphenyl	100702-98-5	PCB metabolite	EC-BKH	Group III Identification unconfirmed
4,4'-dihydroxy-2'-chlorobiphenyl	56858-70-9	PCB metabolite	EC-BKH	Group III Identification unconfirmed
4,4'-dihydroxy-3,3',5,5'-tetrachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
4,4'-thiobiphenyl	NA	Use unknown	Nishihara *et al.*, 2000	*In vitro* agonist ER activity
4-chloro-4'-biphenylol	NA	PCB metabolite	Blair *et al.*, 2000	*In vitro* ER binding affinity
4-chlorobiphenyl [PCB 3]	2051-62-9	CB	EC-BKH	Group III
4-hexyloxybiphenyl	NA	Industrial intermediate chemical	JETOC	Identity unconfirmed
4-hydroxy-2,2',4',5,5'-pentachlorobiphenyl	NA	PCB metabolite	EC-BKH	Group III Identification unconfirmed
4-hydroxy-2,2',5'-trichlorobiphenyl	53905-33-2	PCB metabolite	EC-BKH WWF-CAN	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
4-hydroxy-2,3,3',4',5-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
4-hydroxy-2',3,4',5,5-pentachlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
4-hydroxy-2',3',4',5'-tetrachlorobiphenyl	67651-34-7	PCB metabolite	Kramer & Giesy, 1999 WWF-CAN EC-BKH	*In vitro* ER binding affinity Group III
4-hydroxy-2,3',6'-trichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
4-hydroxy-2',4',6'-trichlorobiphenyl	14962-28-8	PCB metabolite	Kramer & Giesy, 1999 Nishihara *et al.*, 2000 WWF-CAN EC-BKH	*In vitro* ER binding affinity *In vitro* agonist ER activity Group III
4-hydroxy-2',6'-dichlorobiphenyl	79881-33-7	CB metabolite	EC-BKH	Group III Identification unconfirmed
4-hydroxy-2-chlorobiphenyl	23719-22-4	PCB metabolite	EC-BKH	Group III
4-hydroxy-3',3',4',5'-tetrachlorobiphenyl	NA	PCB metabolite	EC-BKH	Group III Identification unconfirmed
4-hydroxy-3,3',4'-trichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
4-hydroxy-3,4',5-trichlorobiphenyl	4400-06-0	PCB metabolite	EC-BKH	Group III
4-hydroxy-3,5-dichlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999 EC-BKH	*In vitro* ER binding affinity Group III
4-hydroxy-3-chlorobiphenyl	NA	Industrial chemical metabolite	Kramer & Giesy, 1999	*In vitro* ER binding affinity
4-methylsulfonyl-2,2',4',5,5',6-hexachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.,* 2000	*In vivo* thyroid hormone disrupter
4-methylsulfonyl-2,2',4',5,5'-pentachlorobiphenyl	NA	Metabolite of chlorinated biphenyls	Kato *et al.,* 2000	*In vivo* thyroid hormone disrupter
Aroclor 1016	12674-11-2	PCB mixture	EC-BKH	Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
Aroclor 1221	11104-28-2	PCB mixture	EC-BKH	Group III
Aroclor 1232	11141-16-5	PCB mixture	EC-BKH	Group III
Aroclor 1242	53469-21-9	Industrial chemical	EC-BKH UBA	Group I
Aroclor 1248	12672-29-6	Industrial chemical	EC-BKH UBA	Group I
Aroclor 1254	27323-18-8	Industrial chemical	EC-BKH UBA	Group I
Aroclor 1260	11096-82-5	Industrial chemical	EC-BKH UBA	Group I
biphenyl	92-52-4	Industrial intermediate; food preservative	EC-BKH	Group III
clophen A30	54991-93-4	PCB mixture	EC-BKH	Group III Identification unconfirmed
clophen A50	8068-44-8	PCB mixture	EC-BKH	Group III Identification unconfirmed
ethyl-4'-hydroxy-4-biphenyl carboxylate	50670-76-3	Use unknown	Schultz *et al.,* 2000b	*In vitro* ER agonist
hydroxy-2,3,4,5-tetrachloro biphenyl [OH-PCB 61]	NA	Hydroxylated metabolite of PCB	Carlson & Williams, 2001; IEH	VTG production in juvenile rainbow trout
hydroxy-2,4,6-trichlorobiphenyl [OH-PCB 30]	NA	Hydroxylated metabolite of PCB	Carlson & Williams 2001	VTG production in juvenile rainbow trout
PCT Aroclor 5442	12642-23-8	PCB mixture	EC-BKH OSPAR	Group III Identification unconfirmed
polychlorinated terphenyls	61788-33-8	Flame retardant; isolator fluid in transformers	EC-BKH	Group III
pyranol	133-63-63	PCB mixture; insecticide & transformers	JETOC	NA

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
BENZOPHENONES & DERIVATIVES				
2,2'-dihydroxy-4,4'-dimethoxybenzophenone	131-54-4	Benzophenone; use unknown	EC-BKH	Group III
2',3,3',4,4',5-hexahydroxybenzophenone	52479-85-3	Benzophenone; use unknown	EC-BKH	Group III
3-hydroxybenzophenone	13020-57-0	Benzophenone; UV photoinitiator	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
2,3,4,4'-tetrahydroxybenzophenon	31127-54-5	Benzophenone; use unknown	EC-BKH	Group III Identification unconfirmed
2,3,4-trihydroxybenzophenone	1143-72-2	Benzophenone; use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
2,4,4'-trihydroxybenzophenone	1470-797	Benzophenone; use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
4,4'-diaminobenzophenone	611-98-3	Benzophenone; use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
4-aminobenzophenone	1137-41-3	Benzophenone; use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
4-chloro-4'-hydroxybenzophenone	42019-78-3	Benzophenone; use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
4-hydroxybenzophenone	1137-42-4	Benzophenone; UV photoinitiator	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
benzophenone [oxodiphenylmethane]	119-61-9	Production of insecticides & pharmaceuticals	Colburn JETOC; SC EC-BKH	*In vitro* ER binding affinity NA Group III
STYRENE AND DERIVATIVES				
1,3,5-triphenylcyclohexane	NA	Styrene oligomer	Satoh *et al.*, 2001	*In vitro* AR binding ability
1a-phenyl-4a-(1'phenylethyl)tetralin	NA	Styrene oligomer	Satoh *et al.*, 2001	*In vitro* AR binding ability
1a-phenyl-4e-(1'phenylethyl)tetralin	NA	Styrene oligomer	Satoh *et al.*, 2001	*In vitro* AR binding ability
1e-phenyl-4a-(1'phenylethyl)tetralin	NA	Styrene oligomer	Satoh *et al.*, 2001	*In vitro* AR binding ability
1e-phenyl-4e-(1'phenylethyl)tetralin	NA	Styrene oligomer	Satoh *et al.*, 2001	*In vitro* AR binding ability

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
2,4,6-triphenyl-1-hexane	NA	Styrene trimer	Colburn; Ohyama *et al.*, 2001; Satoh *et al.*, 2001	*In vitro* MCF-7 cell proliferation *In vitro* AR binding ability
2,4-diphenyl-1-betene	NA	Styrene oligomer	Satoh *et al.*, 2001	*In vitro* AR binding ability
4-hydroxyheptachlorostyrene	NA	Metabolite of octachlorostyrene	Sandau *et al.*, 2000	*In vitro* binding to hTTR
cis-1,2-diphenyl cyclobutane	NA	Styrene dimer	Colburn; Ohyama *et al.*, 2001; Nishihara *et al.*, 2000; Satoh *et al.*, 2001	*In vitro* MCF-7 cell proliferation; *in vitro* androgen recepter binding ability
polystyrene	9003-53-6	Raw material for resin	JETOC	Associated with breast cancer
styrene	100-42-5	Food additive; industrial chemical	SC; UBA WWF-CAN; IEH EC-BKH	Immune suppression; liver dysfunction Group I
trans-1,2-diphenyl cyclobutane	NA	Styrene dimer	Colburn; Ohyama *et al.*, 2001 Satoh *et al.*, 2001	*In vitro* MCF-7 cell proliferation; *in vitro* AR binding ability
SILOXANES				
1,3-diphenyltetramethyl disiloxane	56-33-7	Siloxane; silicone intermediate	EC-BKH	Group III
2,4-trans-diphenyltetramethyl cyclotrisiloxane	31751-59-4	Siloxane; use unknown	EC-BKH	Group III Identification unconfirmed
2,6-cis-dphenylhexamethyl cyclotetrasiloxane	33204-76-1	Siloxane; used in breast implants	Hayden & Barlow, 1972 EC-BKH	*In vivo* oestrogenic effects; disrupter of pituitary functioning Group III
2,6-trans-diphenylhexamethyl cyclotetrasiloxane	33204-77-2	Siloxane; use unknown	EC-BKH	Group III Identification unconfirmed
diphenyl hexamethyl cyclotetra-siloxane	30026-85-8	Siloxanes; use unknown	EC-BKH	Group III Identification unconfirmed
diphenyl tetramethyl cyclotri-siloxane	51134-25-9	Siloxane; use unknown	EC-BKH	Group III Identification unconfirmed
hexamethyldisiloxane	107-46-0	Siloxane	McKim *et al.*, 2001	*In vivo* anti-oestrogenic activity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
octamethylcyclotetrasiloxane	556-67-2	Siloxane	McKim *et al.,* 2001	*In vivo* oestrogenic/anti-oestrogenic activity
o-tolylheptamethylcyclotetra-siloxane	35964-76-2	Siloxane; use unknown	EC-BKH	Group III Identification unconfirmed
phenylheptamethylcyclotetrasilo xane	10448-09-6	Siloxane; use unknown	EC-BKH	Group III
phenylhexamethylcyclotetra-siloxane	17156-72-8	Siloxane; use unknown	EC-BKH	Group III Identification unconfirmed
PhMe[SiCH2CH2SiMePhO]	17964-44-2	Siloxane; use unknown	EC-BKH	Group III Identification unconfirmed
NAPHTHOLS & NAPHTHALENES				
1,2,3,4,6,7-hexachlorinated naphthalene	NA	Waste product of incineration	Omura *et al.,* 2000	LH and FSH disrupter
1,2,3,4-tetrahydro-2-naphthol	530-91-6	Alkylphenol; used in production of antioxidants for synthetic rubber, dyes, perfumes etc	EC-BKH	Group III
1,5-naphthalenediamine	2243-62-1	Dye intermediate	SC	Thyroid adenomas
1-naphthol	90-15-3	Intermediate in dye & perfume manufacture	JETOC EC-BKH	NA Group III
2-napthol	135-19-3	Production of medicine, dyes, perfumes	JETOC EC-BKH	NA Group III
5,6,7,8-tetrahydro-2-naphthol	1125-78-6	NA	JETOC EC-BKH	NA Group III
6-bromonaphthol-2	15231-91-1	NA	JETOC EC-BKH	NA Group III
decahydronaphthalene	91-17-8	Industrial chemical; solvent	SC	NA
Halowax 1014	12616-36-3; 1335-87-1	Chlorinated naphthalene	EC-BKH	Group III
BENZENE & DERIVATIVES				
1-chloro-2-nitrobenzene	88-73-3	Industrial chemical	SC	NA

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
1,2,4-trichlorobenzene	120-82-1	Pesticide intermediate	SC	Adrenal disrupter; CYP450 induction
1,2-dichlorobenzene	95-50-1	Industrial intermediate	SC	CYP450 induction; adrenal dysfunction
1,2,3-trihydroxybenzene	87-66-1	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
1,3,5-trihydroxybenzene	108-73-6	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
4-methylcatechol	452-86-8	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
benzene	71-43-2	Mono-aromatic; industrial solvent	SC	Cytotoxic to oocytes
benzenecarboperoxoic acid	614-45-9	1,1-Dimethylethyl ester; industrial chemical & intermediate	SC	NA
butylbenzene	104-51-8	Industrial chemical; use unknown	SC EC-BKH	NA Group III
catechol	120-80-9	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
ethylbenzene	100-41-4	Manufacture of styrene	ATSDR	Delayed estrus in rats
pentachlorobenzene	608-93-5	Fungicidal intermediate & fire retardant	WWF-CAN EC-BKH	NA Group III
tetrachlorobenzene	12408-10-5	POP	IEH	Thyroid & gonadal dysfunction
trichlorobenzene (all isomers)	12002-48-1	Solvent, dielectric fluid & herbicide intermediate	WWF-CAN EC-BKH	NA Group III
nonyl-4-hydroxybenzoate	38713-56-3	Use unknown	Schultz *et al.*, 2000a	*In vitro* ER agonist
2-ethylhexyl-4'-hydroxy benzoate	5153-25-3	Use unknown	Schultz *et al.*, 2000a Blair *et al.*, 2000	*In vitro* ER agonist *In vitro* ER binding affinity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
phenyl-4-hydroxybenzoate	17696-62-7	Use unknown	Schultz *et al.*, 2000a	*In vitro* ER agonist
isoamyl-4-hydroxybenzoate	6521-30-8	Use unknown	Schultz *et al.*, 2000a	*In vitro* ER agonist
ALCOHOLS & GLYCOLS				
1,2-ethandiol	107-21-1	Antifreeze; coolant; paint	SC	Reproductive toxicity
2,3-dihydroxybenzoic acid	303-38-8	Salicylic acid hydroxylation product	SC EC-BKH	NA Group III
2-butoxyethanol	111-76-2	Glycol ether; solvent; antifreeze	SC	Teratogen
2-ethoxyethanol	110-80-5	Glycol ether	SC	Sperm abnormalities; reproductive toxicity
2-methoxyethanol	109-86-4	Glycol ether	SC	Testicular degeneration
3-ethylphenol	620-17-7	Alkylphenol compound	Blair *et al.*, 2000	*In vitro* ER binding affinity
diethylene glycol monomethyl ether	111-77-3	Pesticide additive	SC	NA
ethanol	64-17-5	Solvent	SC; ECDIN	NA
hexaethyleneglycol-4-iso-octylphenyl ether	NA	NA	JETOC	Identity unconfirmed
methanol	67-56-1	Organic solvent	SC	Adrenal disrupter
polyethelenglycol-mono-octylphenol ether	NA	NA	JETOC	Identity unconfirmed
polyethylene glycol mono-4-nonylphenyl ether N-2	26027-38-3	Use unknown	EC-BKH	Group III
polyethylene glycol nonyl phenyl ether	9016-45-9	Non-ionic surfactant	EC-BKH OSPAR	Group III
AROMATIC HYDROCARBONS				
1,9-dimethylphenanthrene	20291-73-0	Use unknown	EC-BKH	Group III Identification unconfirmed
3-methylcholanthrene	56-49-5	PAH; used in cancer research	SC; Ota *et al.*, 2000; WWF-CAN; EC-BKH	CYP450 induction; affects ovarian steroidogenesis *in vitro* Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
5,6-cyclopento-1,2-benzanthracene	7099-43-6	Use unknown	EC-BKH	Group III Identification unconfirmed
acenaphthene	83-32-9	Production of pesticides, plastics, dyes	Keith, 1997	Cytotoxic to oocytes
anthracene	120-12-7	PAH; production of dyes	SC	Cytotoxic to oocytes
benzo(a)anthracene	56-55-3	Fossil fuel derivative	Keith, 1997 EC-BKH	Cytotoxic to oocytes Group III
benzo(a)pyrene	50-32-8	Combustion product from fossil fuels	SC Colburn EC-BKH	Oestrogenic activity; cytotoxic to oocytes Androgen antagonist Group III
benzo(b)fluoranthene	205-99-2	Fossil fuel derivative	Keith, 1997	Cytotoxic to oocytes
benzo(k)fluoranthene	207-08-9	Fossil fuel derivative	Keith, 1997	Cytotoxic to oocytes
chrysene	218-01-9	PAH	Keith, 1997	Cytotoxic to oocytes
7,12-dimethylbenzanthracene	57-97-6	PAH	C EPA EC-BKH	Adrenal disrupter; cytotoxic to oocytes Group III
pyrene	129-00-0	PAH	Keith, 1997	NA
indeno(1,2,3-c,d)pyrene	193-39-5	PAH	SC	Cytotoxic to oocytes
kerosene	8008-20-6	Petroleum derivative; fuel	SC	NA
phenanthracene	85-01-8	PAH	Keith, 1997	NA
DIPHENYL ETHERS				
2,2',4,4',5,5'-hexabrominated diphenyl ether	NA	Flame retardant	Meerts *et al.,* 2001	*In vitro* antagonist ER activity
2,2',4,4'-tetrabrominated diphenyl ether	5436-43-1	Brominated fire retardant	EC-BKH IEH	Group II
2,2',4,6'-tetrabrominated diphenyl ether	NA	Flame retardant	Meerts *et al.,* 2001	*In vitro* agonist ER activity
2,2'4,4',6-tetrabrominated diphenyl ether	NA	Flame retardant	Meerts *et al.,* 2001	*In vitro* agonist ER activity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
2,3,3',4,4',5,6-heptabrominated diphenyl ether	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* antagonist ER activity
2,3,4,4',5,6-hexabrominated diphenyl ether	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* antagonist ER activity
2,3',4',6-tetrabrominated diphenyl ether	NA	Flame retardant	Zhou *et al.*, 2001 Meerts *et al.*, 2001	Disrupter of thyroid hormones *In vitro* agonist ER activity
2,4,4',6-tetrabrominated diphenyl ether	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* agonist ER activity
2,4,4'-tribrominated diphenyl ether	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* agonist ER activity
2,4,6-tribrominated diphenyl ether	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* agonist ER activity
2,4',6-tribrominated diphenyl ether	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* agonist ER activity
decabrominated diphenyl ether	1163-19-5	Brominated fire retardant	EC-BKH	Group II
octabrominated diphenyl ether	32536-52-0	Brominated fire retardant	Zhou *et al.*, 2001 EC-BKH	Disrupter of thyroid hormones Group II
pentabrominated diphenyl ether	32534-81-9	Brominated fire retardant	EC-BKH	Group II
polychlorinated diethyl ether	NA	Industrial chemical	WWF-CAN	NA
polychlorinated diphenyl ether	NA	Industrial chemical	EC-BKH	Group III Identification unconfirmed
DIPHENYL DERIVATIVES				
2,2'-diphenyl-1,1,1-trichloro ethane	2971-22-4	Pesticide intermediate	EC-BKH	Group III
2,2',4,4'-tetrahydroxybenzil	NA	Diphenyl derivative; use unknown	Blair *et al.*, 2000	*In vitro* ER binding affinity
3-phenylphenol	580-51-8	Diphenyl derivative; commercial usage	Blair *et al.*, 2000	*In vitro* ER binding affinity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
4,4'-dihydroxystilbene	659-22-3	Diphenyl derivative; use unknown	Blair *et al.*, 2000	*In vitro* ER binding affinity
4,4'-ethylene diphenol	6052-84-2	Diphenyl derivative; use unknown	Blair *et al.*, 2000	*In vitro* ER binding affinity
chlorinated diphenyl oxide	55720-99-5	NA	SC	NA
diphenolic acid	126-00-1	Diphenyl derivative	Blair *et al.*, 2000	*In vitro* ER binding affinity
ANILINES & DERIVATIVES				
2-chloroaniline	95-51-2	Propanil metabolite; dye	SC	Adrenal disrupter
3,4-dichloroaniline	95-76-1	Chlorinated aniline; used as herbicide intermediate & dyes	SC; IEH; OSPAR EC-BKH	Adrenal disrupter Group I
4,4-dioxydianiline	101-80-4	Dye	SC	Adrenal disrupter
4,4'-thiodianiline	139-65-1	Dye	SC	Adrenal disrupter
4-chloroaniline	106-47-8	Dye & pharmaceutical intermediate	EC-BKH	Group IIII
aniline	141-85-5	Manufacture of drugs, resins, perfumes	SC	Adrenal disrupter
dimethylaniline	121-69-7	Industrial chemical; dye	SC	Adrenal disrupter
p-chloroaniline HCl	20265-96-7	Dye	SC	Adrenal disrupter
n-benzyl-4-hydroxyaniline	103-14-0	Use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
MISCELLANEOUS COMPOUNDS				
benzothiophene	11095-43-5	NA	SETAC	NA
1-hydroxychlordene	2597-07-11	NA	EC-BKH	NA
1-methyl-2-methylcarbamoyl vinyldimethyl phosphate	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
naphtha	8030-30-6	Petroleum derivative	SC	NA
1-nitropyrene	5522-43-0	Constituent of fossil fuels	Rudel *et al.*, 2001	HAA
1-oxo-1,2,3,4-tetrahydrophenanthrene	573-22-8	Use unknown	EC-BKH	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
1,3-dichloro-2,2-bis(4-methoxy-3-methylphenyl)propane	30668-06-5	Use unknown	EC-BKH	Group III Identification unconfirmed
1-(3,4-dichlorophenyl)-3-methoxyurea	17356-61-5	Use unknown	EC-BKH	Group III
2-amino-1-methyl-6-phenylimidazol[4,5-b]-pyridine	NA	Formed during cooking of meat & fish	Pfau *et al.*, 2000	*In vitro* oestrogenic activity
2-chlor-1,3-butadiene [Chloroprene]	126-99-8	Chemical intermediate in rubber production	SC	NA
2,4-diaminoanisole sulphate	39156-41-7	Industrial dye	SC	NA
2,3-dihydroxypyridine	16867-04-2	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *n vitro* May enter the environment from natural sources
2,4-dihydroxypyridine	626-03-9	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
2,6-dihydroxypyridine	626-06-2	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
2,8-dihydroxy-4b,5,6,10b,11,12-hexahydrochrysene	58024-06-9	Use unknown	EC-BKH	Group III Identification unconfirmed
2,8-dihydroxy-5,6,11,12,13,14-hexahydrochrysene	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
2,4-dihydroxytriphenylmethan carbon acid lacton	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
2,4'-dinitrotoluene	121-14-2	Intermediate in the manufacture of polyurethanes	Rudel *et al.*, 2001	HAA
n-2-fluorenylacetamide	53-96-3	PAH amide derivative; used in medical research	WWF-CAN; PAN UK	Reported by HSDB as never used as a biocide, owing to its carcinogenicity; now used in research
			EC-BKH	Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
naphthoflavone (beta-)	6051-87-2	PAH; industrial chemical	RSC	NA
petroleum	8002-05-9	Industrial chemical	RSC	Affects fish migration and smoultification
2-methyllactonitrile	75-86-5	Use unknown	SC	NA
3-hydroxypyridine	109-00-2	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
3-hydroxy-6-methylpyridine	1121-78-4	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
3-hydroxy-2(hydroxymethyl)pyridine	NA	Present in coal and shale	Lindsay *et al.*, 1992	Inhibition of TPO activity *in vitro* May enter the environment from natural sources
3,5-dichlorophenylcarbamin acid-(1-carboxy-1-methyl)-allyl	88378-55-6	Use unknown	EC-BKH	Group III Identification unconfirmed
n-(3,5-dichlorophenyl)-2-hydroxy-2-methyl-3-butenacidamid	83792-61-4	Use unknown	EC-BKH	Group III Identification unconfirmed
3,9-dihydroxybenz(a)anthracene	56614-97-2	Use unknown	EC-BKH	Group III Identification unconfirmed
4-(2,4,6-tribromophenoxy) phenol	NA	Flame retardant	Meerts *et al.*, 2001	*In vitro* agonist ER activity
4,4'-hexafluroisopropylidene-diphenol	NA	NA	Rudel *et al.*, 2001	HAA Identity unconfirmed
4,4'-methylene bis benzenamine	13552-44-8	Intermediate for isocyanates	SC	NA
thiophene	110-02-1	Aromatic compound; solvent	SC	NA
2-hydroxy benzo(a)pyrene	NA	Use unknown	Nishihara *et al.*, 2000	*In vitro* agonist ER activity
2-hydroxy fluorene	NA	Use unknown	Nishihara *et al.*, 2000	*In vitro* agonist ER activity
3-hydroxy benzo(a)pyrene	13345-21-6	Use unknown	Nishihara *et al.*, 2000	*In vitro* agonist ER activity
4-hydroxyacetophenone	99-93-4	Pharmaceutical intermediate	Nishihara *et al.*, 2000	*In vitro* agonist ER activity

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
4'-hydroxypropiophenone	70-70-2	Use unknown	Schultz *et al.*, 2000a EC-BKH	*In vitro* agonist ER activity Group III
4-hydroxyoctanophenone	2589-73-3	Use unknown	Schultz *et al.*, 2000a	*In vitro* agonist ER activity
4-hydroxyphenyl-di-a-naphthylmethane	135505-63-4	Use unknown	EC-BKH	Group III Identification unconfirmed
4-hydroxy-triphenylmethane	791-92-4	Use unknown	EC-BKH	Group III Identification unconfirmed
4-nitrotoluene	99-99-0	Intermediate for plastic foams, dyestuffs, paints and pharmaceuticals	JETOC; IEH; SC EC-BKH Smith & Quinn, 1992	NA Group III *In vivo* uterotrophic properties
4-nonylphenoxycarbonic acid	NA	NA	JETOC	Identity unconfirmed
4-nonylphenoxy acetic acid	3115-49-9	Lubricants, fuels, greases, antifoaming agent in gasoline, hydraulic fluids, cutting oils	EC-BKH	Group III
4-nonylphenoxycarboxylic acid	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
ammonia	7664-41-7	Industrial chemical	RSC	NA
amsonic acid	81-11-8	Stilbene; production of dyes, detergents & bleach	Smith & Quinn, 1992	*In vivo* uterotrophic properties
aurin	603-45-2	Dye intermediate; microbial reagent	Blair *et al.*, 2000	*In vitro* ER binding affinity
bis(4-hydroxyphenyl) ((2-phenoxysulfonyl)phenyl]) methane	115481-73-7	Use unknown	EC-BKH	Group III Identification unconfirmed
C.I. Basic red 9 monohydrochloride	569-61-9	Dye	SC	Adrenal & thyroid carcinogen
C.I. Direct blue 218	28407-37-6	Dye	SC	NA
carbon monoxide	630-08-0	Product of incomplete combustion	C EPA	Stimulates release of adrenal hormone (adrenaline)

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
chlorinated paraffin	108171-26-2	Used as plasticiser & lubricant additive	SC	NA
chlorodifluoromethane	75-45-6	CFC; refrigerator coolant	SC	Male reproductive effects
chloroform	67-66-3	Industrial solvent & cleansing agent	SC; Colburn	Adrenal & reproductive disrupter
chloropropane	540-54-5	Industrial chemical		NA
decaethyleneglycol 4-isooctylphenyl ether	NA	NA	JETOC	Identity unconfirmed
dehydrodoisynol acid	5684-12-8	Use unknown	EC-BKH	Group III
dichloromethane	75-09-2	Industrial chemical; solvent & fumigant	SC	CYP450 induction
diesel exhaust emissions	NA	Waste product from diesel	Taneda *et al.,* 2000; Watanabe & Kurita, 2001	*In vitro* anti-oestrogenic activity; disrupter of maternal circulating hormones & AGD in offspring
diesel oil water-soluble fraction	NA	Fuel	Pacheco & Santos, 2001	Inhibition of plasma cortisol
dimethylcarbamyl chloride	79-44-7	Chemical intermediate for pharmaceuticals & pesticides	EC-BKH	Group III
dimethylformamide	68-12-2	Industrial solvent	EC-BKH	Group III
diphenyl-a-naphthylcarbinol	630-95-5	Use unknown	EC-BKH	Group III Identification unconfirmed
epichlorohydrin	106-89-8	Industrial chemical; solvent; pesticide & resins manufacture	SC EC-BKH	Temporary sterility Group III
ethane dimethane sulphonate	NA	Alkylating sulfonic acid ester	Gray *et al.,* 1999 Colburn	Cytotoxic to Leydig cells
formaldehyde, polymer with 4,4'-(1-methylidene)bis(phenol)	25085-75-0	Use unknown	EC-BKH	Group III; identification unconfirmed
formaldehyde, polymer with nonylphenol	9040-65-7	Use unknown	EC-BKH	Group III Identification unconfirmed
gasoline water soluble fraction	NA	Fuel	Pacheco & Santos, 2001	Inhibition of plasma cortisol

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
HC Blue 1	2784-94-3	Dye	SC	Thyroid adenomas
heptaoctatrikosan-1-ol,23-(nonylphenoxy)3,6,9,12,15,18,21-nonylphenol monoethoxylate	2717-05-5	Use unknown	EC-BKH	Group III Identification unconfirmed
hydrazine	302-01-2	Industrial chemical; reducing agent	SC	Thyroid tumours
linseed oil, reaction products	93572-41-9	Use unknown	EC-BKH	Group III
malein anhydride, monoester with ethoxylated nonylphenol	NA	Use unknown	EC-BKH	Group III Identification unconfirmed
methyl tertiary butyl ether [MTBE]	1634-04-4	Petroleum additive	IEH EC-BKH	Thyroid disrupter Group III
mono-OH-MDDE	75938-34-0	Use unknown	EC-BKH	Group III Identification unconfirmed
nitrogen dioxide	10102-44-0	By-product of combustion	SC	Adrenal & reproductive disrupter
o-cresol	95-48-7	Pesticide intermediate	SC	Increase in estrus length
octoxynol	9002-93-1	Use unknown	EC-BKH	Group III
1-epoxyethyl-3,4-epixycyclohexane	106-87-6	NA	SC	NA
p-chlorophenyl isocyanate	104-12-1	Urea herbicide intermediate	SC	NA
pentachloroanisole	1825-21-4	Degradation product of pentachlorophenol or pentachloronitrobenzene	SC	NA
perfluorooctane sulfonate	1763-23-1	Fluorinated surfactant	Colburn	Thyroid & reproductive disrupter
polycarbonate	25971-63-5	Raw material for resin	JETOC	NA
poly(oxy-1,2-ethanediyl), alpha-(isooctylphenyl)-omega-hydroxy	9004-87-9	Use unknown	EC-BKH	Group III
poly(oxy-1,2-ethanediyl), alpha - [(1,1,3,3-tetramethyl butyl)phenyl]-omega-hydroxy	9036-19-5	Non-ionic surfactant	EC-BKH	Group III

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
poly(oxy-1, 2-ethanediyl), alpha-((1,1,3,3-tetramethyl-butyl) phenyl)-omega-hydroxyphosphate	52623-95-7	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(3-octylphenyl) -omega-hydroxy	81642-15-1	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(4-isooctylphenyl)-omega-hydroxy-	51651-58-2	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(dinonylphenyl)-omega-hydroxy-forgrenet	68891-21-4	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(iso-nonylphenyl)-omega-hydroxy-phosphate	37205-87-1	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(nonylphenyl)-omega-hydroxy-forgrenet	68412-54-4	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(octylphenyl)-omega-hydroxy-forgrenet	9036-89-2	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(octylphenyl)-omega-hydroxy-forgrenet	68987-90-6	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-(phenylmethyl)-omega-((1,1,3,3-tetramethyl-butyl)-phenoxy)	60864-33-7	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-sulfo-omega-(nonylphenoxy)-	9014-90-8	Phenol; use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-sulpho-omega-((1,1,3,3,-tetramethyl-butyl)-phenoxy)	55348-40-8	Use unknown	EC-BKH	Group III Identification unconfirmed

Table 1 continued General anthropogenic chemicals

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
Poly(oxy-1,2-ethanediyl), alpha-sulpho-omega(2,4,6-tris (1-methylpropyl)phenoxy)-sodium	109909-39-9	Use unknown	EC-BKH	Group III Identification unconfirmed
poly(oxy-1,2-ethanediyl), alpha-sulpho-omega-(octylphenyl)-forgrenet	69011-84-3	Use unknown	EC-BKH	Group III Identification unconfirmed
tetrachlorobenzyl toluene	NA	Industrial chemical	EC-BKH WWF-CAN	Group III Identification unconfirmed
tetrachloroethylene	127-18-4	Solvent	EC-BKH	Group II
tris-4-(chlorophenyl)methane	NA	Marine microcontaminant; source unknown	Lascombe et al., 2000	In vitro oestrogenic activity
tris-4-(chlorophenyl)methanol	NA	Marine microcontaminant; source unknown	Lascombe et al., 2000	In vitro oestrogenic activity
thiourea	62-56-6	Industrial chemical	RSC	Thyroid adenomas
vinyl acetate	108-05-4	Industrial intermediate	WWF-CAN EC-BKH	NA Group III
polyvinyl chloride	9002-86-2	Raw material for resin	JETOC	Associated with breast cancer

Table 2 Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
PYRETHROIDS				
1-cyhalothrin	68085-85-8	Pyrethroid ester insecticide & acaricide	WWF-CAN	NA
allethrin (d-trans) [bioallethrin]	584-79-2	Pyrethroid insecticide	Colburn; FoE; UBA Eil & Nisula, 1990 EC-BKH	Oestrogen & androgen antagonist SHBG binding Group III
bifenthrin [talstar]	82657-04-3	Pyrethroid insecticide	Akhtar *et al.,* 1996; WWF-CAN EC-BKH	Suppression of T3 &T4 Group III
cimetidine	51481-61-9	Pyrethroid insecticide	Eil & Nisula, 1990	Androgen antagonist
cyfluthrin	68359-37-5	Pyrethroid insecticide	Eil & Nisula, 1990	*In vitro* AR binding affinity
cypermethrin	52315-07-8	Pyrethroid insecticide	SC EC-BKH	NA Group III
deltamethrin	52918-63-5	Pyrethroid insecticide	FoE; WWF-CAN EC-BKH	Testicular degeneration Group III
esfenvalerate	66230-04-4	Pyrethroid insecticide	SC EC-BKH	NA Group III
ethofenprox	80844-07-1	Pyrethroid insecticide	WWF-CAN EC-BKH	Reduction in T3 & T4 Group III
fenothrin [phenothrin; sumithrin]	26002-80-2	Pyrethroid insecticide	Colburn; Eil & Nisula, 1990; JETOC EC-BKH	Androgen antagonist NA Group III
fenvalerate	51630-58-1	Pyrethroid insecticide	Colburn; SC Eil & Nisula, 1990 EC-BKH	Oestrogenic activity Androgen antagonist Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
fluvalinate	102851-06-9	Pyrethroid insecticide	Eil & Nisula, 1990	Androgen antagonist
permethrin	52645-53-1	Pyrethroid insecticide	Colburn;Eil & Nisula, 1990; SC; IEH EC-BKH	Oestrogenic activity; androgen antagonist; Group III
pyrethrin	121-29-9	Pyrethroid insecticide	Eil & Nisula, 1990; WWF-CAN EC-BKH	Androgen antagonist; affects SHBG binding; thyroid hyperplasia Group III
resmethrin	10453-86-8	Pyrethroid insecticide	Eil & Nisula, 1990 EC-BKH	Androgen antagonist Group III
tefluthrin (karate)	79538-32-2	Pyrethroid insecticide	Akhtar *et al.,* 1996 Colburn	Suppression of T4 & T3 Thyroid disrupter
lambda-cyhalothrin	91465-08-6	Pyrethroid insecticide	WWF-CAN EC-BKH	NA Group III
alpha-cypermethrin	67375-30-8	Pyrethroid acaricide	PAN UK	NA
bioresmethrin	28434-01-7	Pyrethroid insecticide	PAN UK	NA
s-bioallethrin	28434-00-6	Pyrethroid	PAN UK	NA
tetramethrin	7696-12-0	Pyrethroid insecticide	PAN UK	NA
fluvalinate	69409-94-5	Pyrethroid ester insecticide & acaricide	EC-BKH	Group III
ORGANOCHLORINES & METABOLITES				
3,5,6-trichloro-2-pyridinol	6515-38-4	Degradation product of chlorpyrifos	Rudel *et al.,* 2001	HAA
4,4'-DDD	72-54-8	OC biocide	SC; Rudel *et al.,* 2001 EC-BKH	HAA Group III
aldrin	309-00-2	OC insecticide	Colburn SC EC-BKH	*In vitro* ER binding affinity Group II

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
camphechlor [Toxaphene]	8001-35-2	OC insecticide	Colburn OSPAR; SC EC-BKH	Thyroid & oestrogen disrupter Growth retardation Group I
carbon tetrachloride	56-23-5	OC insecticide	SC	Adrenal dysfunction
chlordane	57-74-9	OC insecticide	Colburn UBA; SC; IEH; OSPAR EC-BKH	Progesterone & T disrupter Adrenal disrupter; altered reproductive function Group I
chlordane (cis)	5103-71-9	Chlordane isomer	SC	NA
chlordecone [kepone]	143-50-5	OC pesticide	IEH; OSPAR; SC Colburn EC-BKH	Thyroid carcinoma & adenoma ER & AR binding affinities Group I
clofentezine [chlorfentezine]	74115-24-5	OC acaricide	WWF-CAN; Colburn EC-BKH	Thyroid disrupter Group III
DDE (p,p'-)	72-55-9	OC insecticide	SC Colburn; IEH EC-BKH	Oestrogenic & anti-androgenic activity; Group III
DDT (o,p'-)	789-02-6	OC insecticide	SC; IEH ; Colburn EC-BKH	Oestrogenic activity; adrenal disrupter Group III
DDT (p,p'-)	50-29-3	OC insecticide	SC; UBA Colburn; IEH; OSPAR EC-BKH	Oestrogenic disrupter Group I
DDT (tetrachloro-)	3563-45-9	OC insecticide	EC-BKH UBA; WWF-CAN; Colburn	Group I & III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
dicofol [kelthane]	115-32-2	OC acaricide	SC; OSPAR Colburn; IEH EC-BKH	Thyroid dysfunction Oestrogenic disrupter Group II
dieldrin	60-57-1	OC insecticide	SC; Colburn; OSPAR EC-BKH	*In vitro* ER binding affinity Group II
endosulfan	115-29-7	OC insecticide & acaricide	SC; Colburn; IEH; OSPAR EC-BKH	Anti-oestrogenic activity; decreases T, FSH & LH levels Group II
endrin	72-20-8	OC insecticide; avicide & rodenticide	SC; WWF-CAN EC-BKH	NA Group II
heptachlor	76-44-8	OC insecticide	SC Colburn EC-BKH	Increases serum oestrogen & progesterone levels Thyroid disrupter Group II
hexachlorobenzene	118-74-1	OC fungicide; insecticide	SC; UBA; OSPAR EC-BKH	Thyroid & gonadal disrupter; Group I
lindane [gamma-HCH]	58-89-9	OC insecticide	SC; UBA; Colburn; IEH; OSPAR EC-BKH	Oestrogenic disrupter Group I
methoxychlor	72-43-5	OC insecticide	SC; OSPAR Colburn; IEH EC-BKH	Uterotrophic activity; testicular degeneration Group III
mirex	2385-85-5	OC insecticide	SC; UBA Colburn EC-BKH	CYP450 induction; blocks ovulation Androgen antagonist; LH inhibition Group I
nonachlor, (cis-)	5103-73-1	OC insecticide	SC EC-BKH	NA Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
nonachlor, (trans-)	39765-80-5	OC insecticide	SC; Colburn EC-BKH	Potential ER agonist Group III
oxychlordane	27304-13-8	Residue of chlordane	SC; Colburn EC-BKH	Reproductive disrupter Group II
pentachlorophenol	87-86-5	OC insecticide, fungicide, herbicide & molluscicide	SC EC-BKH	Adrenal, thyroid & pituitary disrupter Group III
photomirex	39801-14-4	OC insecticide	WWF-CAN EC-BKH	NA Group II
p,p'-methoxychlor-monophenol	2846-038	Use unknown	EC-BKH	Group III
dihydroxymethoxychlor olefin	NA	Metabolite of methoxychlor	Blair et al., 2000	*In vitro* ER binding affinity Identification unconfirmed
dihydroxymethoxychlor	NA	Metabolite of methoxychlor	Blair et al., 2000	*In vitro* ER binding affinity Identification unconfirmed
monohydroxymethoxychlor olefin	NA	Metabolite of methoxychlor	Blair et al., 2000	*In vitro* ER binding affinity Identification unconfirmed
monohydroxymethoxychlor	NA	Metabolite of methoxychlor	Blair et al., 2000	*In vitro* ER binding affinity Identification unconfirmed
2,2-bis(4-chlorophenyl)-acetic acid [o,p'-DDA]	34113-46-7	Metabolite of DDT	EC-BKH	Group III
l-chloro-2,2-bis(p-chlorophenyl) ethylene [o,p'-DDMU]	14835-94-0	Sediment degradation product of DDE	EC-BKH	Group III
1-chloro-2-(2,2-dichloro-1-(4-chlorophenyl)ethyl)-benzene [o,p'-DDD]	53-19-0	Chemotherapeutic agent; constituent of pesticide DDD	EC-BKH	Group III
delta-hexachlorocyclohexane	319-86-8	OC insecticide	EC-BKH	Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
hexachlorocyclohexane (mixture)	608-73-1	OC insecticide	SC EC-BKH	 Group III
1,1,1-trichloro-2,2-bis(4-hydroxyphenyl)ethane [HPTE]	2971-36-0	Methoxychlor metabolite	EC-BKH	Group III
methoxychlor olefin [MDDE]	2132-70-9	Environmental degradation product of methoxychlor	EC-BKH	Group III
3-methoxy-o,p'-DDA	65148-76-7	DDT metabolite	EC-BKH	Group III Identification unconfirmed
3-methoxy-o,p'-DDE	65148-80-3	DDT metabolite	EC-BKH	Group III Identification unconfirmed
3-hydroxy-o,p'-DDT	43216-70-2	DDT metabolite	EC-BKH	Group III Identification unconfirmed
4-methoxy-o,p'-DDE	65148-81-4	DDT metabolite	EC-BKH	Group III Identification unconfirmed
4-methoxy-o,p'-DDT	65148-72-3	DDT metabolite	EC-BKH	Group III Identification unconfirmed
5-methoxy-o,p'-DDA	65148-77-8	DDT metabolite	EC-BKH	Group III Identification unconfirmed
5-methoxy-o,p'-DDD	65148-75-6	DDT metabolite	EC-BKH	Group III Identification unconfirmed
5-methoxy-o,p'-DDE	65148-82-5	DDT metabolite	EC-BKH	Group III Identification unconfirmed
5-methoxy-o,p'-DDT	65148-74-5	DDT metabolite	EC-BKH	Group III Identification unconfirmed
5-hydroxy-o,p'-DDT	65148-73-4	DDT metabolite?	EC-BKH	Group III Identification unconfirmed
3,4'-DDD	4329-12-8	DDT metabolite?	EC-BKH	Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
o,p'-DDA-glycinat	65148-83-6	DDT metabolite?	EC-BKH	Group III Identification unconfirmed
4,4'-DDA	NA	DDT metabolite?	EC-BKH	Group III Identification unconfirmed
4,4'-DDMU	NA	DDT metabolite?	EC-BKH	Group III Identification unconfirmed
alpha-endosulfan	959-98-8	Endosulfan isomer; OC insecticide & acaricide	EC-BKH SC	Group II
beta-endosulfan	33213-65-9	Endosulfan isomer; OC insecticide & acaricide	EC-BKH SC	Group II
o,p'-DDE	3424-82-6	OC insecticide metabolite	EC-BKH	Group III
Beta-hexachlorocyclohexane	319-85-7	OC insecticide	IEH; OSPAR; SC EC-BKH	Group III
chlordene	3734-48-3	Residue of chlordane	EC-BKH	Group III
heptachlor epoxide	1024-57-3	Cyclodiene insecticide; raw material for resin	Colburn SC EC-BKH	Thyroid & reproductive disrupter Decreases uterine implantations Group III
CARBAMATES				
aldicarb	116-06-3	Carbamate; insecticide	SC EC-BKH	NA Group III
asulam	3337-71-1	Carbamate; pesticide	SC	NA
carbaryl	63-25-2	Carbamate; insecticide	Colburn; SC IEH EC-BKH	Oestrogen & progesterone disrupter Decreases sperm count; sperm abnormalities Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
carbofuran	1563-66-2	Carbamate; insecticide & nematicide	FoE; UBA; IEH; WWF-CAN EC-BKH	Testicular & immune degeneration; Group III
diethyldithiocarbamic acid [thiram]	20624-25-3	Carbamate; pesticide & fungicide	Parvizi *et al.*, 1998	Affects female offspring fertility
fenoxycarb	72490-01-8	Carbamate; insecticide	SC EC-BKH	NA Group III
methomyl	16752-77-5	Oxime carbamate; insecticide & acaricide	SC Colburn EC-BKH	NA Thyroid disrupter Group III
ORGANOPHOSPHATES				
acephate	30560-19-1	OP insecticide	EC-BKH	Group III
chlorfenvinphos	470-90-6	OP pesticide	RSC; UBA EC-BKH	Growth retardation; affects fish gonadal development Group III
chlorpyrifos	2921-88-2	OP pesticide	SC	NA
diazinon	333-41-5	OP pesticide	RSC; IEH; Colburn EC-BKH	Affects pheromone recognition in male fish Group II
dichlorvos	62-73-7	OP insecticide & acaricide	EC-BKH	Glucocorticoid increase; immune degeneration Group III
dimethoate	60-51-5	OP insecticide	SC; UBA; WWF-CAN; IEH EC-BKH	Thyroid dysfunction; testicular degeneration Group II
elsan [fenthoate]	2597-03-7	OP pesticide	RSC EC-BKH	NA Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
fenitrothion	122-14-5	OP pesticide	Colburn RSC; WWF-CAN EC-BKH	AR antagonist Olfactory suppressant in fish Group III
fenthion	55-38-9	OP pesticide	RSC	Affects fish oocyte development
glufosinate-ammonium	77182-82-2	OP herbicide	WWF-CAN EC-BKH	NA; Group III
glyphosate	1071-83-6	OP herbicide	Lin & Garry, 2000 EC-BKH	*In vitro* oestrogenic activity Group III
malathion [cythion]	121-75-5	OP insecticide	Colburn; IEH SC EC-BKH	Thyroid disrupter Affects fish oocyte development Group II
mevinphos	7786-34-7	OP pesticide	RSC EC-BKH	Affects fish oocyte development Group III
monocrotophos	6923-22-4	OP pesticide	RSC	Decreased growth rate; affects fish oocyte development
oxydemeton-methyl	301-12-2	Aliphatic organothiophosphate;OP insecticide	FoE; UBA EC-BKH	Gonadal degeneration Group III
parathion	56-38-2	OP insecticide & acaricide	SC; IEH EC-BKH	Adrenal disrupter Group II
parathion-methyl	298-00-0	OP insecticide	SC; WWF-CAN; IEH EC-BKH	NA Group II
phenthoate	2597-03-7	OP insecticide	RSC	Affects fish oocyte development
quinalphos	13593-03-8	OP pesticide	RSC EC-BKH	NA Group III
ronnel [fenchlorfos]	299-84-3	OP insecticide	WWF-CAN EC-BKH	NA Group III
temephos	3383-96-8	OP pesticide	RSC	NA

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
TEPA	545-55-1	OP pesticide	RSC EC-BKH	NA Group III
tetrachlorvinphos	22248-79-9	OP pesticide	RSC EC-BKH	NA Group III
trichlorfon	52-68-6	OP insecticide and acaricide	UBA; Trajkovic *et al.*, 1981 EC-BKH	Gonadal effects & mammary tumours; disrupter of steroid binding capacity in adrenal & testes Group III
demephion-o	682-80-4	OP insecticide	EC-BKH	Group III
demeton-s-methyl	919-86-8	OP acaricide & insecticide	EC-BKH	Group III
formothion	2540-82-1	OP acaricide & insecticide	EC-BKH	Group III
glufosinate	51276-47-2	OP herbicide	EC-BKH	Group III
omethoate	1113-02-6	OP acaricide & insecticide	EC-BKH	Group III
phosphamidon (mixed isomers)	13171-21-6	OP acaricide & insecticide	EC-BKH	Group III
HERBICIDES				
2,4,5-T	93-76-5	Phenoxy herbicide	SC EC-BKH	Gonadotoxic & teratogen Group III
2,4-D	94-75-7	Phenoxy herbicide	SC; IEH EC-BKH	Thyroid dysfunction Group II
fluazifop-butyl	69806-50-4	Phenoxy herbicide	JETOC EC-BKH	NA Group III
quizalofop-ethyl	76578-12-6	Phenoxy herbicide	JETOC EC-BKH	NA Group III
2,4-dichlorophenoxybutyric acid	94-82-6	Phenoxy herbicide	EC-BKH	Group III
acetochlor	34256-82-1	Amide herbicide	Colburn; WWF-CAN; UBA; IEH EC-BKH	Thyroid disrupter Group I

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
alachlor	15972-60-8	Amide herbicide	Colburn SC; UBA; IEH EC-BKH	Thyroid disrupter Thyroid & gonadal effects Group I
pronamide	23950-58-5	Amide herbicide	WWF-CAN EC-BKH	Affects ovarian & thyroid histopathology Group III
atrazine	1912-24-9	Triazine herbicide	Colburn SC; UBA; IEH; OSPAR EC-BKH	Disrupter of LH & T Inhibits hormone metabolism & delays postnatal development Group I
cyanazine	21725-46-2	Triazine herbicide	SC EC-BKH	Persistent estrus in rats Group III
ethiozin	64529-56-2	Triazine herbicide	WWF-CAN EC-BKH	Reduction in T3 & T4 levels Group III
simazine	122-34-9	Triazine herbicide	US EPA 1997b; WWF-CAN; IEH EC-BKH	Persistent estrus in rats Group II
terbutryn	886-50-0	Triazine herbicide	WWF-CAN; EC-BKH	Mammary, testis & thyroid tumours Group III
prometryn	7287-19-6	Triazine herbicide	EC-BKH	Group III
epiconazole	NA	Triazole pesticide	EC-BKH	Group II
dinocap	39300-45-3	Dinitrophenol fungicide & acaricide	SC EC-BKH	NA Group III
dinoseb	88-85-7	Dinitrophenol herbicide	JETOC	Affects male fertility; fetal development; growth
oryzalin	1904-48-83	Dinitroaniline herbicide	WWF-CAN EC-BKH	NA Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
pendimethalin	4048-74-21	Dinitroaniline herbicide	Hurley *et al.,* 1998; WWF-CAN; Colburn EC-BKH	Enhances thyroid hormone clearance Group III
prodiamine	29091-21-2	Dinitroaniline herbicide	Hurley *et al.,* 1998 WWF-CAN; Colburn EC-BKH	Linked with thyroid hyperplasia Group III
trifluralin	1582-09-8	Dinitroaniline herbicide	SC; Colburn EC-BKH	Thyroid carcinomas; disrupter of serum LH, cortisol & insulin Group III
ioxynil	1689-83-4	Hydroxybenzonitrile herbicide	SC; WWF-CAN EC-BKH	NA Group III
bromacil	314-40-9	Uracil herbicide	SC EC-BKH	Causes increased incidence of thyroid tumours Group III
bromacil lithium salt	53404-19-6	Herbicide	SC	NA
dacthal [chlorthal]	2136-79-0	Phthalic acid herbicide	JETOC	NA
DCPA	1861-32-1	Phthalic acid herbicide	WWF-CAN	Reduction in T4 levels; thyroid tumours
procymidone	32809-16-8	Dicarboximide fungicide	Colburn FoE EC-BKH	AR antagonist Group III
tri-allate	2303-17-5	Thiocarbamate herbicide	Rawlings *et al.,* 1998	Disrupter of serum levels of LH and insulin
amitrole [aminotriazole]	61-82-5	Triazole herbicide	Colburn IEH; SC EC-BKH	Thyroid dysfunction Group II
bromoxynil	1689-84-5	Benzonitrile herbicide	JETOC; WWF-CAN EC-BKH	NA Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
chlormequat chloride	999-81-5	Ammonium plant growth regulator	SC	NA
diquat dibromide	85-00-7	Quaternary ammonium herbicide	RSC	NA
diuron	330-54-1	Phenylurea herbicide	RSC; IEH EC-BKH	NA Group II
linuron	330-55-2	Urea herbicide	FoE; UBA; Colburn; IEH EC-BKH	AR antagonist Group I
metholachlor	51218-45-2	Chloroacetanilide herbicide	IEH	NA
metribuzin	21087-64-9	Triazinone herbicide	SC; Colburn EC-BKH	Thyroid disrupter Group III
molinate	2212-67-1	Thiocarbamate herbicide	JETOC; WWF-CAN EC-BKH	Reduced female fertility Group III
nitrofen	1836-75-5	Diphenyl ether herbicide	SC; Colburn EC-BKH	Thyroid disrupter Group II
norflurazon	27314-13-2	Pyridazinone herbicide	SC	NA
picloram	1918-02-1	Pyridine herbicide	SC EC-BKH	Thyroid adenomas Group III
propanil	709-98-8	Anilide herbicide	SC; IEH EC-BKH	NA Group II
thiazopyr	117718-60-2	Pyridine herbicide	Colburn; WWF-CAN EC-BKH	Thyroid hormone disrupter Group III
FUNGICIDES				
cyproconazole	94361-06-5	Conazole fungicides	EC-BKH	Group III
difenoconazole	119446-68-3	Conazole fungicides	EC-BKH	Group III
epoxiconazole	135319-73-2	Azole fungicide	FoE; UBA; Colburn EC-BKH	Disrupter of gonadal hormones; ovarian tumours Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
fenbuconazole	114369-436	Conazole fungicide	WWF-CAN; Colburn EC-BKH	Enhance thyroid hormone clearance Group III
flutriafol	76674-21-0	Conazole fungicides	EC-BKH	Group III
hexaconazole	79983-71-4	Conazole fungicide	US EPA 1997b	Decreased numbers of corpora lutea
Imazalil	35554-44-0	Conazole fungicide	EC-BKH	Group III
ketoconazole	65277-42-1	Conazole fungicide	RSC Colburn EC-BKH	Adrenal disrupter; testosterone suppression Reproductive disrupter Group III
myclobutanil	88671-89-0	Conazole fungicides	EC-BKH	Group III
penconazole	66246-88-6	Conazole fungicide	FoE; UBA EC-BKH	Thyroid & gonadal effects Group III
prochloraz	67747-09-5	Azole fungicide	FoE; UBA; IEH EC-BKH	Pituitary disrupter Group II
propiconazole	60207-90-1	Azole fungicide	FoE; UBA; IEH EC-BKH	Affects steroid metabolism Group III
tebuconazole	107534-96-3	Conazole fungicide	EC-BKH	Group III
triadimefon	4312-14-33	Conazole fungicide	Hurley *et al.,* 1998 Vinggaard *et al.,* 1999 WWF-CAN; Colburn EC-BKH IEH	Increases thyroid tumour incidence *In vitro* ER agonist Group II
triadimenol	55219-65-3	Conazole fungicide	Vinggaard *et al.,* 1999 EC-BKH	*In vitro* ER agonist Group III
mancozeb	8018-01-7	Dithiocarbamate fungicide	SC Colburn; IEH EC-BKH	Thyroid & LH inhibition Thyroid disrupter Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
maneb	12427-38-2	Dithiocarbamate fungicide	Colburn; SC UBA; IEH EC-BKH	Thyroid & LH inhibition Group I
metam natrium	137-42-8	Dithiocarbamate fungicide, herbicide & nematicide	UBA; IEH EC-BKH	 Group I
metiram	9006-42-2	Dithiocarbamate fungicide	FoE; SC EC-BKH	Thyroid & LH inhibitor Group III
nabam	142-59-6	Dithiocarbamate fungicide & algicide	SC EC-BKH	Thyroid & LH inhibitor Group III
thiram	137268	Dithiocarbamate fungicide	Colburn; UBA; IEH EC-BKH	LH & thyroid disrupter Group I
zineb	12122-67-7	Dithiocarbamate fungicide	UBA; SC; IEH EC-BKH	Thyroid dysfunction; LH inhibitor Group I
ziram	137-30-4	Dithiocarbamate fungicide	SC; IEH EC-BKH	Pituitary & thyroid carcinoma Group II
bitertanol	55179-31-2	Triazole fungicide	EC-BKH	Group III
benomyl	17804-35-2	Benzimidazole fungicide; metabolite	SC; Spencer *et al.,* 1996; WWF-CAN EC-BKH	Increases FSH levels; changes in uterine ER & PR expression Group III
carbendazim	10605-21-7	Benzimidazole fungicide	FoE; IEH Colburn EC-BKH	Thyroid & testicular degeneration Reproductive disrupter Group II
chlozolinate	72391-46-9	Dicarboximide fungicide	Gray *et al.,* 1999	Structurally similar to vinclozolin; no effects *in vivo*
ethylenethiourea (2-imidazolidinethione)	96-45-7	Imidazole; industrial uses & contaminant of fungicides; anti-thyroid drug	SC; Colburn; IEH EC-BKH	Thyroid disrupter Group III
etridiazole	2593-15-9	Thiazole fungicide	WWF-CAN EC-BKH	Mammary & testicular tumours Group III

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
fenarimol	60168-88-9	Pyrimidine fungicide	Colburn JETOC; WWF-CAN EC-BKH	ER agonist Decreases thyroid levels; affects fish oocyte development Group III
Ferbam	14484-64-1	Dimethyldithiocarbamate fungicide	SC	Inhibits LH surge
imidazole	288-32-4	Imidazole fungicide	RSC	NA
iprodione	3673-41-97	Imidazole fungicide	Colburn; IEH EC-BKH	T synthesis disrupter; testicular & ovarian tumour induction Group II
pentachloronitrobenzene [Quintozene]	82-68-8	Aromatic fungicide	Colburn; Keith, 1997; WWF-CAN EC-BKH	Enhances thyroid hormone secretion Group III
pyrimethanil	53112-28-0	Pyrimidine fungicide	Colburn	Thyroid hormone disrupter
tridemorph	24602-86-6	Morpholine fungicide	UBA	Inhibits steroid metabolism
vinclozolin	50471-44-8	Dicarboximide fungicide	Colburn; IEH; SC UBA; OSPAR EC-BKH	Anti-androgenic activity Group I
MISCELLANEOUS				
1,2-dibromo-3-chloropropane [DBCP]	96-12-8	Pesticide & industrial intermediate	SC; IEH EC-BKH	Alters sex differentiation Group III
1,2-dibromoethane	106-93-4	Nematicide & insecticide	JETOC; Colburn EC-BKH	Reproductive toxicant Group III
1,2-dichloropropane	78-87-5	Solvent & insect fumigant	SC	CYP450 induction
1-(3,4-dichlorophenyl)-3-methyl urea	3567-32-2	NA	EC-BKH	Group III
2,2'-methylenebis(4-chlorophenol) [Dichlorophen]	97-23-4	Chlorophenol algicide, bactericide & fungicide	Blair *et al.,* 2000	*In vitro* ER binding affinity

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
3-trifluoromethyl-4-nitrophenol	NA	Lampricide	Hewitt *et al.,*1998	Estrogen agonist
abamectin [Avermectin]	71751-41-2	Antibiotic, acaricide, nematicide & insecticide	EC-BKH	Group III
amitraz	33089-61-1	Amidine; insecticide & acaricide	FoE EC-BKH	Affects noradrenaline; inhibits LH: disrupts estrus Group III
azadirachtin	11141-17-6	Botanical insecticide	EC-BKH	Group III
carbon disulfide	75-15-0	Insecticide & industrial chemical	SC IEH WWF-CAN	Behavioural effects
chlorochorine chloride	NA	Residue of chlormequat	Hagemeister *et al.,* 1999	Affects LH & progesterone levels in pregnant mice; identity unconfirmed
chlordimeform	6164-98-3	Formamidine; acaricide & insecticide	JETOC EC-BKH	Inhibits LH surge Group III
cycloheximide	66-81-9	Antibiotic, fungicide; plant growth regulator	C EPA	Disrupter of LH secretion *in vitro*
cycliphosphamide	50-18-0	Nitrogen mustard derivative; chemotherapy & chemosterilant; insecticide	EC-BKH	Group III
diflubenzuron	35367-38-5	Insecticide; chemosterilant & chitin synthesis inhibitor	SC EC-BKH	Disrupter of insect moulting Group III
dinitro-o-cresol	534-52-1	Herbicide, insecticide & industrial chemical	RSC NIOSH; ECDIN	Increase in estrus length Hyperglycaemic
fipronil	120068-37-3	Pyrazole insecticide & acaricide	Colburn; WWF-CAN EC-BKH	Thyroid disrupter Group III
hexachloro-1,3-butadiene	87-68-3	Fumigant; waste product	SC	Adrenal degeneration
methropene, S-	40596-69-8	Insecticide; juvenile hormone mimic	La Clair et al., 1998	Metamorphism dysfunction

Table 2 continued Biocidal products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
methylbromide	74-83-9	Industrial applications & biocidal fumigant	EC-BKH IEH	Group II
octachlorostyrene	29082-74-4	Pesticide	Colburn; SC EC-BKH	Thyroid disrupter Group III
paraquat	4685-14-7	Quaternary ammonium herbicide	Edmonds & Edwards, 1996; WWF-CAN EC-BKH	Increase in serum corticosterone levels in rats Group III
piperonyl butoxide	51-03-6	Insecticide synergist	WWF-CAN EC-BKH	Linked with thyroid hyperplasia Group III
precocene	17598-02-6	Insecticide; insect growth regulator	Landau & Rao, 1980	Anti-alatotrophins
pyriminil	53558-25-1	Rodenticide	SC	NA
pyriproxyfen	95737-68-1	Phenyl ether insecticide	RSC	NA
sodium tetraborate	1303-96-4	Pesticide active ingredient	SC	NA
tetrasul	2227-13-6	Pesticide	SC	NA
thiophanate ethyl	23564-06-9	Carbamate fungicide	SC	NA
tebufenozide	112410-23-8	Insecticide; insect growth regulator	Hahn *et al.,* 2001	Molting-hormone antagonist in insects

Table 3 Biogenic compounds

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
FLAVANONES				
apigenin	520-36-5	Flavanoid; fruit, vegetables, etc	Rosenberg *et al.,* 1998; Oberdoerster *et al.,* 2001	Progestin agonist; inhibition of i*n vitro* ER-dependent gene transcription
hesperetin	520-33-2	Flavanone; found in citrus fruits	Rosenberg *et al.,* 1998	Progestin antagonist
naringenin	10236-47-2	Flavanoid; found in citrus fruits	Rosenberg *et al.,* 1998	Progestin agonist
8-prenylnaringenin	NA	Prenylflavonoids	Coldham & Sauer, 2001	*In vitro* oestrogenic activity
6-prenylnaringenin	NA	Prenylflavonoids	Coldham & Sauer, 2001	*In vitro* oestrogenic activity
diprenylnaringenin	NA	Prenylflavonoids	Coldham & Sauer, 2001	*In vitro* oestrogenic activity
xanthohumol	569-83-5; 6754-58-1	Prenylflavonoids	Coldham & Sauer, 2001	*In vitro* oestrogenic activity
isoxanthohumal	NA	Prenylflavonoids	Coldham & Sauer, 2001	*In vitro* oestrogenic activity
chrysin	480-40-0	Flavone	Oberdoerster *et al.,* 2001	Inhibition of i*n vitro* ER-dependent gene transcription
glyceollins	NA	Flavonoid-related phytoallexin compounds	Burow *et al.,* 2001	*In vitro* ER antagonism
glabridin	NA	Flavanoid extracted from liquorice	Tamir *et al.,* 2000	*In vitro* ER binding ability
luteolin	491-70-3	Flavone	Oberdoerster *et al.,* 2001	Inhibition of i*n vitro* ER-dependent gene transcription
quercetin	117-39-5	Flavone	Oberdoerster *et al.,* 2001	Inhibition of *in vitro* ER-dependent gene transcription

Table 3 continued Biogenic compounds

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
VITAMINS				
carotene (beta-)	7235-40-7	Antioxidant vitamin	Rosenberg *et al.,* 1998	Androgen antagonist
folic acid	59-30-31	Vitamin B	Rosenberg *et al.*, 1998	Progestin antagonist
all- trans retinoic acid	302-79-4	Metabolite of vitamin A	C EPA	Interference with metamorphosis
PHENOL ACIDS				
4-vinylguaiacol	7786-61-0	Phenol; occurs in tobacco, beans, coffee, malt	EC-BKH	Group III
coumaric, (p-) acid	7400-08-0	Phenol acid	EC-BKH	Group III
coumaric (m-) acid	14755-02-3	Phenol acid; found in tea & red wine	Rosenberg *et al.*, 1998	Progestin antagonist
ferulic acid	1135-24-6	Phenol acid; found in tea & red wine	Rosenberg *et al.,* 1998	Progestin antagonist
LIGNANS				
enterodiol	NA	Lignan	IEH	Oestrogenic agonism
enterolactone	78473-71-9	Lignan	IEH	Oestrogenic agonism
ISOFLAVONOIDS				
coumestrol	497-13-0	Isoflavonoid	IEH	Oestrogenic
daidzein	486-66-8	Isoflavonoid	IEH	Oestrogenic
equol	534-95-3	Isoflavonoid	SETAC; Nishihara *et al.,* 2000	Oestrogen agonist; i*n vitro* ER agonist
formononetin	485-72-3	Isoflavonoid; found in clover, soybean	SETAC EC-BKH	Oestrogen agonist Group III
genistein	446-72-0	Isoflavonoid; found in soy	IEH	Oestrogen agonist
o-desmethylangolensin	NA	Isoflavonoid	Schmitt *et al.,* 2001	*In vitro* ER binding affinity
genistin	529-59-9	Isoflavonoid	Allred *et al.,* 2001	*In vivo* mammary tumour promoter

Table 3 continued Biogenic compounds

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
dihydrogenistein	NA	Isoflavonoid metabolite	Nishihara *et al.,* 2000	*In vitro* ER agonist
prunetin	552-59-0	Isoflavonoid; derived from cherries	Wahlqvist & Dalais, 2001	Oestrogenic activity
PLANT STEROLS				
resveratrol	501-36-0	Constituent of wine	SETAC; Henry & Witt, 2001	*In vitro oestrogenic* activity
sitosterol (beta-)	83-46-5	Present in plant	RSC	Androgenic activity
ANTHRAQUINONES				
emodin	518-82-1	Hydroxyanthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
emodin 8-O-beta-D-glucopyranoside	NA	Hydroxyanthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
alizalin	NA	Hydroxyanthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
2,6-dihydroxyanthraquinone	84-60-6	Hydroxyanthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
chrysophanol	481-74-3	Anthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
chrysophanol 8-O-beta-D-glucopyranoside	NA	Anthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
1,8-dihydroxyanthraquinone	117-10-2	Anthraquinones	Matsuda *et al.*, 2001	*In vitro* MCF-7 cell proliferation & ER binding
STEROIDS				
17beta-oestradiol	50-28-2	Oestrogen	IEH OSPAR	Oestrogenic activity
oestrone	53-16-7	Oestrogen	IEH OSPAR	Oestrogen agonist

Table 3 continued Biogenic compounds

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
testosterone	58-22-0	Androgen	IEH	Androgenic activity
MISCELLANEOUS				
chlorogenic acid	327-97-9	Present in coffee	Rosenberg *et al.*, 1998	Androgen antagonist
anethole	104-46-1	Extract from fennel; flavouring agent & perfumery	Wahlqvist & Dalais, 2001	Oestrogenic activity
biochanin A	491-80-5	Phytoestrogen	IEH EC-BKH	 Group III
chlorophylline	11006-34-1	All green plants	Rosenberg *et al.*, 1998	Androgen; progestin antagonist
chromene	254-04-6	Plant extract	Landau & Rao, 1980	Anti-alatotrophins
colupulone	NA	Beta bitter acid derived from hops	Wahlqvist & Dalais, 2001	Oestrogenic activity
deoxymiroestrol	NA	Phytoestrogen	Chansakaow *et al.,* 2000	*In vitro* oestrogenic activity
homocysteine	462-10-2	Used in treatment of folic acid deficiency	Rosenberg *et al.*, 1998	Androgen & progestin antagonist
indolo(3,2-b)carbazole	241-55-4	Indole carbinol; found in Brassica spp.	RSC EC-BKH	Oestrogen antagonist Group III
licochalcone A	58749-22-7	Phytoestrogen; extracted from liquorice	Rafi *et al.,* 2000	*In vitro* oestrogenic activity
syringic acid	530-57-4	Cinamic acid derivative; tea & red wine	Rosenberg *et al.*, 1998	Progestin agonist
taxifolin	480-18-2	Natural component of tea & red wine	Rosenberg *et al.*, 1998	Androgen/progestin antagonist
tetrahydrocannabinol	1972-03-8	Cannabinoid; found in cannabis	SETAC	Oestrogenic activity
thiocyanate	463-56-9	Aglycone metabolite of glycosinolates; found in plant material	SC; Lindsay & Gaitan, 1989; WWF-CAN EC-BKH	Thyroid enlargement; disrupter of TPO activity and iodine uptake Group III
tomartine	NA	Phytoestrogen	Oberdoerster *et al.,* 2001	Ecdysteroid synergist
zearalenone	17924-92-4	Resorcylic acid lactone; fungal toxin	IEH	Oestrogenic activity

Table 3 continued Biogenic compounds

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
alpha-zearalenone	NA	Zearalenone derivative	Minervini *et al.*, 2001	*In vitro* oestrogenic activity
zearalanone	NA	Zearalenone derivative	Minervini *et al.*, 2001	*In vitro* oestrogenic activity

Table 4 Pharmaceutical products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
1,4-butanediol dimethanesulfonate	55-98-1	Chemotherapeutic agent	C EPA	Spermatozoa depletion
acetazolamide	59-66-5	Carbonic anhydrase inhibitor	C EPA	Hyperglycaemia
alprazolam	2898-19-77	Benzodiazepine	C EPA	Inhibits corticotrophin secretion
aminoglutethimide	125-84-8	Anti-aromatase	C EPA	Inhibits oestrogen steroidogenesis
amiodarone	1951-25-3	Pharmaceutical	SC	Thyroid dysfunction
amiodarone hydrochloride	19774-82-4	Pharmaceutical	SC	Thyroid dysfunction
amoxapine	14028-44-5	Antidepressant	SC	Dopamine antagonist; increases prolactin
anisindione	117-37-3	Coumarin derivative; anticoagulant	C EPA	NA
atenolol	2912-26-87	Beta-blocker	C EPA	Beta-adrenic antagonist
auranofin	3403-13-28	Antirheumatic	C EPA	Reproductive toxicant
beclomethasone dipropionate	5534-09-8	Corticosteroid	C EPA	Steroid
benzethonium chloride	121-54-0	Antiseptic; anti-infectant; spermicide	SC	NA
carbamazepine	298-46-4	Anticonvulsant	C EPA	Affects circulating thyroid hormones
chlorodiazepoxide	58253	Benzodiazepine	C EPA	TRH hormone antagonist
chloroquine	54-05-7	Anti-malarial drug	US EPA 1997b; Okanlawon & Ashiru, 1992	Disrupter of estrus cycle; suppresses LH and circulating oestrogen level
clobetasol propionate	25122467	Topical corticosteroid	C EPA	Steroidal qualities
clomiphene citrate	50419	Used in fertility treatment	C EPA	Induction of ovulation
cobalt chloride	7646-79-9	Anti-haematinic	SC	NA
cyclosporin A	59865-13-3	Pharmaceutical	SC	NA

Table 4 continued Pharmaceutical products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
danasol	1723-08-85	Used in treatment of endometriosis	C EPA	Disrupter of oestrus cycle
demeclocycline	127-33-3	Anti-bacterial	SC	Teratogenic
diazoxide	364-98-7	Used for hyperglycaemia	C EPA	Disrupter of insulin secretion
diazepam	439-14-5	Pharmaceutical	ECDIN	Affects male reproductive organs
diethylstilboestrol [DES]	56-53-1	Synthetic oestrogen	SC; OSPAR IEH	Oestrogenic activity
diphenylhydantoin	630-93-3	Anti-convulsant	SC	Hirsutism; gynaecomastia
disulfiram	97-77-8	Used in alcohol aversion therapy	Caroldi & de Paris, 1995	Disrupter of adrenal dopamine levels
equilenin	517-09-9	Steroid; used in HRT	SETAC	Oestrogen agonist
equilin	474-86-2	Steroid; used in HRT	SETAC	Oestrogen agonist
ethinyl oestradiol	57-63-6	Synthetic oestrogen	IEH OSPAR	Oestrogen agonist
etoposide	33419-42-0	Chemotherapeutic	SC	Reproductive organ degeneration
iodinated glycerol	5634-39-9	Expectorant	SC	NA
keoxifene	82640-04-8	Benzothiophene derivative	Chou *et al.,* 1992	Oestrogen antagonist
lithium carbonate	554-13-2	Anti-manic drug; ceramic glaze	SC	Autoimmune atrophic thyroiditis
lorazepam	846-49-1	Anxiolytic	SC	NA
mestranol	72-33-3	Synthetic oestrogen; contraceptive	IEH; OSPAR EC-BKH	Oestrogen agonist Group III
methimazole	60-56-0	Anti-hyperthyroid agent	SC; Fort *et al.*, 1998	Thyroid disrupter in amphibians
methylthiouracil	56-04-2	Thyroid inhibitor	SC	Thyroid disrupter
nalidixic acid	389-08-2	Anti-bacterial uses	SC	Disrupts fetal development
nandrolone	434-22-0	Androgen	IEH	AR binding in muscle
norethisterone	68-22-4	Synthetic progestogen	SC	Mammary tumours in rats

Table 4 continued Pharmaceutical products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
oxazepam	604-75-1	Anxiolytic	SC	Male gonadal degeneration
oxyphenbutazone	129-20-4	Pharmaceutical; anti-inflammatory	SC	NA
phenolphthalein	77-09-8	Phenol; cathartic	Blair *et al.,* 2000 EC-BKH	*In vitro* ER binding affinity Group III
procarbazine hydrochloride	366-70-1	Anti-neoplastic	SC	NA
propilthiouracil	51-52-5	Anti-hyperthyroid agent	SC	Thyroid disrupter
resorcinol	108-46-3	Anti-seborrheic; industrial chemical	Lindsay & Gaitan, 1989 Colburn SC; WWF-CAN; IEH EC-BKH	Thyroid disrupter Group I
sulfamethazine	57-68-1	Anti-bacterial	SC	NA
sulfamethoxazole	723-46-6	Anti-bacterial; anti-pneumocytic	SC	Thyroid dysfunction
sulpiride	15676-16-1	Anti-depressant & anti-psychotic agent	Advis *et al.,* 1981	Dopaminergic recepter blocker
theobromine	83-67-0	Diuretic & bronchodilator	SC	NA
theophylline	58-55-9	Bronchodilator	SC	NA
tocophenol	148-03-8	Antioxidant vitamin	Rosenberg *et al.*, 1998	Androgen/progestin antagonist
tolbutamide	64-77-7	Anti-diabetic agent	SC	Disrupter of fetal development
trifluorperazine	117-89-5	Tranquilliser	Chou *et al.,* 1992	Oestrogen antagonist
phenolphthalol	81-92-5	Phenol; cathartic	EC-BKH	Group III
2,5-dihydroxybenzoic acid	490-79-9	Benzoic acid; used as anti-pyretic analgesic & anti-rheumatic	EC-BKH	Group III
doisynolic acid	482-49-5	Oestrogenic carboxylic acid	EC-BKH	Oestrogenic properties
allenolic acid [2-hydroxy-6-naphthylpropion acid]	553-39-9	Non-steroidal, oestrogenic carboxylic acid; intermediate in oestrogenic compound production	EC-BKH	Group III

Table 5 Inorganics and organo-metallic complexes

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
aluminium	7429-90-5	Metal	WWF-CAN; UBA	Thyroid disrupter in anurans
asbestos	132207-33-1	Silica; fire retardants	RSC	NA
arsenic	7440-38-2	Metal	SC; Colburn; Kaltreider *et al.*, 2001	Affects pituitary & sex hormone synthesis; testicular degeneration; *in vitro* alteration of glucocorticoid recepter expression
arsine	7784-42-1	Hydride of arsenic	SC	Liver dysfunction
bromine	7726-95-6	Halogen	SC	Thyroid dysfunction
cadmium	7440-43-9	Metal; battery ingredient	SC	Increases FSH level; testicular degeneration
			Colburn	ER agonism
cadmium chloride	10108-64-2	Fungicide, dye	SC	Gonadal toxicity; decrease in CYP450 activity
chlorine	7782-50-5	Halogen	JETOC	NA
chromium	7440-47-3	Metal	RSC	Immune & gonadal degeneration
cobalt sulphate heptahydrate	10026-24-1	Drying agent for varnishes and inks	SC	NA
copper	7440-50-8	Metal	RSC	Testicular dysfunction; affects fish migration and smoultification
cyanide	57-12-5	Metal	RSC	Affects fish steroid secretion
			EC-BKH	Group III

Table 5 continued Inorganics and organo-metal complexes

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
ferrocene	102-54-5	Organo-iron complex; fuel oil additive	SC	NA
hydrogen cyanide	74-90-8	Industrial intermediate & fumigant	SC	Thyroid enlargement
iodine[2]	7553-56-2	Halogen; anti-hyperthyroid drug	SC; WWF-CAN	Thyroid dysfunction
iron	7439-89-6	Metal	RSC	NA
lead	7439-92-1	Metal	SC; Colburn	Endocrine & reproductive dysfunction
manganese	7439-96-5	Metal; production of industrial chemicals	RSC	Human impotence (CNS)
mercuric chloride (II)	7487-94-7	Metal fungicide	SC	Adrenal carcinoma
nitrate	14797-55-8	Industrial chemical	RSC	NA
nitrite	14797-65-0	Food impurity	RSC	Carcinogenic
quartz	14808-60-7	Silica mineral	SC	NA
urea	57-13-6	Industrial chemical	RSC	Thyroid dysfunction
sulphide	18496-25-8	Industrial chemical	RSC	NA
mercury	7439-97-6	Metal	SC	Affects hypothalamus-pituitary axis; sex steroid synthesis
			Colburn	Reproductive & thyroid disrupter
nickel sulphate	7786-81-4	Metal salt; used in electroplating industry	SC	Immune dysfunction, hypoglycaemia
oxine-copper	10380-28-6	Metal fungicide	SC	NA
selenium	7782-49-2	Metal: industrial applications	RSC	Enlarged adrenal glands
strontium	10476-85-4	Metal	SC	NA
tin	7440-31-5	Metal	RSC	Thyroid & adrenal gland disrupter

[2] Radioactive iodine (^{131}I, CAS No. 10043-66-0) has also been listed by SC and EC-BKH as causing thyroid disruption and is classified as Group III

Table 5 continued Inorganics and organo-metal complexes

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
zinc	7440-66-6	Metal	RSC	Affects fish smoultification and migration
bis(tributyltin)oxide	56-35-9	Organo-metal complex; fungicide, algicide, molluscicide & bactericide	SC; UBA	Affects thyroid, adrenal & thymus gland function; aromatase inhibitor
di-n-butyltin dichloride	683-18-1	Organo-metal complex; stabiliser in PVC	Nakagomi *et al.*, 2001	*In vitro* microtubule damage to V79 cells
fentin acetate	900-95-8	Organotin fungicide, algicide & molluscicide	JETOC EC-BKH	NA Group I
methoxyetylacrylate tributyltin	NA	Organo-metal complex; use unknown	EC-BKH	Group I
methyl methacrylate-tributyltin methacrylate copolymer	26354-18-7	Organo-metal complex; antifouling product	UBA EC-BKH	 Group I
monotributyltin salicylate; tributylstannyl salicylate; tri-n-butyltin salicylate; phenol, 2-[(tributylstannyl)oxy] carbonyl	4342-30-7	Organo-metal complex; biocide	UBA EC-BKH	 Group I
stannane, (1,2-phenylenebis)carbonyloxy	4782-29-0	Organo-metal complex; use unknown	UBA EC-BKH	 Group I Identification unconfirmed
stannane, tributyl[1,2,3,4,4a,4b,5,6,1]	26239-64-5	Organo-metal complex; use unknown	EC-BKH	Group I Identification unconfirmed
stannane, tributyl-, mono(naphthenoyloxy	85409-17-2	Organic metal complex; masonry preservative	EC-BKH	Group I Identification unconfirmed
tributyltin carboxylate	56148-40-4	Organo-metal complex; wood preservative	EC-BKH	Group I
tributyltinpolyethoxylate	NA	Organo-metal complex; use unknown	EC-BKH	Group I Identification unconfirmed

Table 5 continued Inorganics and organo-metal complexes

Chemical Name	CAS No	Chemical Group and/or Use	Reference source	Notes
Tributyltin [Stannane, tributyl]	56573-85-4	Organo-metal molluscicide	Colburn; IEH IEH; WWF-CAN EC-BKH	Reproductive disrupter Group I
tri-n-butyltin chloride	1461-22-9	Organo-metal complex; biocide	Nakagomi *et al.*, 2001	*In vitro* microtubule damage to V79 cells
tributyltin hydride	688-73-3	Organo-metal complex (tin); antifoulant	UBA; SC EC-BKH	NA Group I
tetrabutyltin	1461-25-2	Industrial chemical	EC-BKH	Group III
tributyltin benzoate	4342-36-3	Organo-metal complex; biocide	UBA EC-BKH	 Group I
tributyltin-naphthalate	36631-23-9	Organo-metal complex; fibre preservative	EC-BKH	Group I
tributyltin linoleate	24124-25-2	Organo-metal complex; fibre preservative	EC-BKH	Group I
tributyltin oleate	3090-35-5	Organo-metal complex; wood preservative	EC-BKH	Group I
tributyltin fluoride	1983-10-4	Organo-metal complex; wood preservative	EC-BKH	Group I
tributyl [(2-methyl-1-oxo-2-propenyl)oxy] stannane	2155-70-6	Organo-metal complex; wood preservative	EC-BKH UBA	Group I
tripropyltin	2279-76-7	Organo-metal complex; use unknown	EC-BKH	Group I Identification unconfirmed
triphenyltin	NA	Organo-metal complex; use unknown	EC-BKH	Group I Identification unconfirmed

Table 6 Consumer products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
4-methyl-benzylidene camphor	36861-47-9	UVA & UVB sun screen	Schlumpf *et al.,* 2001	*In vitro* oestrogenic activity
benzophenone-3	131-57-7	UVA & UVB sun screen	Schlumpf *et al.,* 2001	*In vivo* & *vitro* oestrogenic activity
butyl paraben [(Butyl -p-hydroxybenzoate; N-butyl-4-hydroxybenzoate)]	94-26-8	Alkyl hydroxy benzoate; antioxidant, preservative, stabiliser and antiseptic	Routledge 1998; Satoh *et al.,* 2000; Taneda *et al.,* 2000; Blair *et al.,* 2000; Schultz *et al.,* 2000a; Nishihara *et al.,* 2000	Oestrogenic activity; *in vitro* ER binding affinity; *in vitro* ER agonist
butylated hydroxyanisole [t-BHA]	25013-16-5	Food additive & preservative	Colburn RSC; WWF-CAN; IEH; OSPAR EC-BKH	*In vitro* ER binding affinity Oestrogenic activity Group III
homosalate	118-56-9	UVA & UVB sunscreen	Schlumpf *et al.,* 2001	*In vitro* oestrogenic activity
irganox 1640	2082-79-3	Antioxidant	JETOC	NA
octyl-dimethyl-PABA	21245-02-3	UVA & UVB sunscreen	Schlumpf *et al.,* 2001	*In vitro* oestrogenic activity
octyl-methoxycinnamate	5466-77-3	UVA & UVB sunscreen	Schlumpf *et al.,* 2001	*In vivo* & *in vitro* oestrogenic activity
R11	126-15-8	Insect repellent	SC	Decrease in steroid levels
isobutyl p-hydroxybenzoate	4247-02-03	Preservative, stabiliser & antiseptic	Taneda *et al.,* 2000	*In vitro* ER binding affinity
isopropyl p-hydroxybenzoate	4191-73-5	Preservative, stabiliser & antiseptic	Taneda *et al.,* 2000; Satoh *et al.,* 2000	*In vitro* ER binding affinity
propyl-p-hydroxybenzoate [propylparaben]	94-13-3	Alkyl hydroxybenzoate; preservative, stabiliser & antiseptic	Taneda *et al.,* 2000; Blair *et al.,* 2000; Routledge, 1998; Nishihara *et al.,* 2000; Satoh *et al.,* 2000	*In vitro* ER binding affinity; *in vitro* agonist ER activity

Table 6 continued Consumer products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
ethyl p-hydroxybenzoate	120-47-8	Alkyl hydroxybenzoate; preservative, stabiliser & antiseptic	Taneda *et al.*, 2000; Blair *et al.*, 2000; Routledge, 1998; Schultz *et al.*, 2000a; Nishihara *et al.*, 2000; Satoh *et al.*, 2000	*In vitro* ER binding affinity; oestrogenic activity
methyl p-hydroxybenzoate [methyl p-hydroxybenzoate; methylparaben]	99-76-3	Alkyl hydroxybenzoate; preservative, stabiliser & antiseptic	Taneda *et al.*, 2000; Nishihara *et al.*, 2000; Blair *et al.*, 2000; Satoh *et al.*, 2000; Routledge, 1998	*In vitro* ER binding affinity; oestrogenic activity
2,4-dihydroxybenzophenone [benzophenone-1]	131-56-6	Phenol additive; sunscreen or stabiliser	Miller *et al.*, 2001; Blair *et al.*, 2000 EC-BKH	*In vitro* ER agonist; *in vitro* ER binding affinity Group III
2,2',4,4'-tetrahydroxybenzophenone	131-55-5	Phenol additive; sunscreen or stabiliser	Miller *et al.*, 2001; Schultz *et al.*, 2000a	*In vitro* agonist ER activity
4,4'-dihydroxybenzophenone	611-94-4	Phenol additive; sunscreen	Miller *et al.*, 2001; Schultz *et al.*, 2000a; Nishihara *et al.*, 2000; Blair *et al.*, 2000 EC-BKH	*In vitro* agonist ER activity; *in vitro* ER binding affinity Group III
phenyl salicylate	118-55-8	Phenol additive; sunscreen	Miller *et al.*, 2001	*In vitro* agonist ER activity
resorcinol monobenzoate	136-36-7	Phenol additive; sunscreen	Miller *et al.*, 2001	*In vitro* agonist ER activity
benzylparaben	94-18-8	Phenol additive; preservative	Miller *et al.*, 2001; Schultz *et al.*, 2000b; Blair *et al.*, 2000	*In vitro* agonist ER activity; *in vitro* agonist ER activity; *in vitro* ER binding affinity
chlorothymol	89-68-9	Phenol additive; disinfectant	Miller *et al.*, 2001	*In vitro* agonist ER activity

Table 6 continued Consumer products

Chemical Name	Cas No	Chemical Group and/or Use	Reference source	Notes
4-t-amylphenol [4-tert-pentylphenol]	80-46-6	Phenol additive; disinfectant	Miller *et al.*, 2001; Schultz *et al.*, 2000b EC-BKH	*In vitro* agonist ER activity Group III
4-chloro-3,5-dimethylphenol	88-04-0	Phenol additive; disinfectant; topical antiseptic & germicide	Miller *et al.*, 2001; Nishihara *et al.*, 2000	*In vitro* agonist ER activity
4-methylphenol	106-44-5	Phenol; disinfectant	Nishihara *et al.*, 2000	*In vitro* agonist ER activity
heptyl-4-hydroxybenzoate	1085-12-7	Paraben; food antioxidant, preservative, anti-microbial agent	Blair *et al.*, 2000	*In vitro* ER binding affinity
nordihydroguariaretic acid	500-38-9	Antioxidant in oils & fats	Blair *et al.*, 2000	*In vitro* ER binding affinity
4-hydroxy-n-butyrophenone	1009-11-6	NA	EC-BKH	Group III
isobutyl-p-hydroxybenzoate	4247 02 3	Alkyl-p-hydroxybenzoate; preservative, stabiliser & antiseptic	Satoh *et al.*, 2000	*In vitro* ER binding affinity

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