

Thought Starter Paper on Endocrine Disrupting Pesticides and the Strategic Approach to International Chemicals Management (SAICM)

Pesticides Action Network (PAN) and IPEN
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Executive summary

Endocrine disrupting (ED) pesticides are a threat to human health and the environment with potentially serious lifelong effects especially when the developing foetus and small children are exposed. The nature of their use results in deliberate release into the environment and results in pervasive environmental contamination. For SAICM work on EDCs to be relevant to developing and transition countries where chemical exposures due to agriculture are significant, ED pesticides should be included in the EDC workplan. We believe that there are several key activities that could advance chemical safety and reduction of exposures to ED pesticides with very modest resource requirements:

- 1) Including ED pesticides in a report on EDCs that is targeted to developing countries and countries with economies in transition
- 2) Developing a list of ED pesticides, including both active and inert ingredients; and identification of the uses to which these ED pesticides are put and the processes and products in which they are found
- 3) Awareness-raising on ED pesticides including disseminating a list of ED pesticides, identifying uses and health effects, information on environmental contamination and human body burden, and including ED pesticides in a clearinghouse on EDCs
- 4) Case study on ED pesticides including identification, health effects, exposure of children, gaps in regulatory policy, best practices in substitution, and country needs for regulation and substitution

Background

At ICCM3 all stakeholders, including more than 120 countries, adopted by consensus a resolution on endocrine disrupting chemicals (EDCs) that recognized *"the potential adverse effects of endocrine disruptors on human health and the environment...and the need to protect humans, and ecosystems and their constituent parts that are especially vulnerable, as set forth in, inter alia, paragraph 14(b) of the Overarching Policy Strategy of the Strategic Approach."*

All stakeholders also agreed "to promote actions on endocrine disrupting chemicals [as] an emerging policy issue."¹

¹ SAICM/ICCM.3/24, Resolution 3/2 F, para. 1

All classes of EDCs are of concern and action is urgently required to reduce harmful exposures to humans and wildlife. A recent UNEP/WHO report states that one measure to safeguard the health of women and children is the minimization of chemical exposures before conception and through gestation, infancy, childhood and adolescence.² For more information on the effects of ED pesticides, please see Annex 1.

Within the broader group of EDCs, ED pesticides can be considered a specific group of chemicals meriting special attention because of the way in which they are used, their large impact on developing and transition countries due to the importance of agriculture, and because safer alternatives are readily available.

Rationale

1. In their normal course of use in agriculture and public health protection, ED pesticides are released deliberately into the environment, often in a broad-scale dispersive manner such that they now contaminate all environmental media such as soil, surface and groundwater, air, rain, fog, snow, and biota in all regions of the world, including areas in which they have not been used such as the Arctic and Antarctic regions, and high mountains.³
2. Use of ED pesticides occurs in a wide range of activities, including the production of food, flowers and ornamentals, animal feed, and fiber; on companion and captive animals; in the management of livestock, domestic, educational, healthcare and industrial premises; in the management of pests in transport vehicles and vessels, and utility operations; in the management of turf and ornamentals; in disease vector and public nuisance insect control; and in products including consumer products such as pyrethroid-impregnated clothing.
3. Agriculture plays a vital role in developing and transition country economies, making pesticides the most significant chemical releases. In highly industrial countries, agriculture generally occupies less than 5% of the employed workforce. However in Latin America, the Middle East and the countries of the former Soviet Union, nearly one-fifth (20%) of employed workers are in agriculture. In North Africa and East Asia the number rises to more than one-third. In South and Southeast Asia nearly half the workforce is in agriculture. In Sub-Saharan Africa, two-thirds of all employed workers engage in agricultural activities.⁴

² WHO, UNEP. 2012. State of the Science of Endocrine Disrupting Chemicals 2012. <http://www.who.int/ceh/publications/endocrine/en/>

³ Pimentel D. 2005. Environmental and economic costs of the application of pesticides primarily in the United States. *Environ Dev Sustain* 7:229-52.

⁴ *Employment by sector*, ILO 2007; <http://www.ilo.org/public/english/employment/strat/kilm/download/kilm04.pdf>

4. Food is regarded as the main source of current-use pesticide exposure for the general public; but pesticides can also be inhaled and absorbed through the skin, resulting in high exposure, especially in workers.⁵
5. In many instances ED pesticides can be replaced with safer alternatives, particularly ecosystem-based approaches to agricultural production, vector control, and household pest control.⁶
6. Further work is needed to identify, and replace with safer alternatives, ED pesticides used in products and industrial processes.

Activities on ED pesticides in the intercessional period between ICCM3 and ICCM4

We believe there are several key activities that could be undertaken with very modest resources to help reduce exposure of the developing foetus and newly born children to ED pesticides. These activities should be included in the intercessional activities conducted for EDCs and reported on at ICCM4. Intercessional activities on ED pesticides could include:

1. Including ED pesticides in a report on EDCs that is targeted to developing countries and countries with economies in transition (CEITs)

This report would satisfy the element of the resolution which calls for *“timely updates to the 2012 report on the state of the science of endocrine-disrupting chemicals...with particular attention to the needs of developing countries and CEITs”* as well as *“recommending potential measures that could contribute to reductions in exposures to or the effects of endocrine-disrupting chemicals.”* The report could build on the referenced 2012 report, and provide a targeted focus on developing and transition countries. For proposed elements of the report, please see Annex 2.

2. Developing a comprehensive list of ED pesticides

To facilitate public awareness-raising and control actions, EDC project activities should assemble a comprehensive list of ED pesticides including both active and inert ingredients. A number of lists of ED pesticides exist, such as substances mentioned in the UNEP/WHO report, the TEDX list referred to in the UNEP/WHO report, and the Highly Hazardous Pesticides (HHP) list developed by PAN which includes ED pesticides on the basis of the EU categorisation for endocrine disruption.⁷ Note that a significant number of substances on the Rotterdam Annex III and Stockholm Convention lists are ED pesticides and these might be prioritized for action. Please see Annex 3 for more information.

⁵ WHO, UNEP. 2012. State of the Science of Endocrine Disrupting Chemicals 2012. <http://www.who.int/ceh/publications/endocrine/en/>

⁶ UNEP/POPS/POPRC.8/INF/14/Rev.1;

<http://synergies.pops.int/2013COPs/ExCOPs/Documents/tabid/2915/language/en-US/Default.aspx>

⁷ http://www.pan-germany.org/download/PAN_HHP-List_1306.pdf

3. Awareness-raising on ED pesticides

The ICCM3 resolution on EDCs calls for information exchange, dissemination and networking on EDCs. ED pesticides should be part of intercessional awareness-raising activities and include the following components:

- Disseminating a comprehensive list of ED pesticides (see above)
- Identifying uses and health effects of ED pesticides⁸
- Collecting and disseminating information on environmental contamination and human body burden⁹
- Including ED pesticides in a clearinghouse on EDCs¹⁰

To help enable a more informed discussion among participants at the regional and sub-regional workshops, and to provide tangible data that might be useful in assessing existing knowledge, capacity and needs of governments on EDCs, a survey that includes questions about ED pesticides could be sent to participants beforehand, to be returned at the meeting.

4. Case study on ED pesticides

The ICCM3 resolution on EDCs calls for, *"...the development of case studies and advice on translation of research results into control actions."* A case study on ED pesticides with regional input would be highly relevant to developing and transition countries and could include the following elements:

- Identification of ED pesticides and their health effects
- Exposure of children to ED pesticides¹¹
- Gaps in existing legislation, policies, guidelines and practices that prevent adequate regulation of, and reduced exposure to, ED pesticides
- Best practices in substitution¹²

⁸ Pesticides are used in a wide variety of ways including some that are not immediately apparent to people, and which consumers would be unaware of, such as in impregnated clothing. It would be helpful to countries and other stakeholders if all such uses are identified, so that safer replacements can be found and unsafe exposures reduced.

⁹ A survey of available information on environmental contamination with ED pesticides and human body burden studies, especially current-use pesticides would be of assistance in identifying priorities for replacement with best practice alternatives.

¹⁰ It would be very helpful to countries if the results of the surveys and case studies could be organized and available online. Regulators would benefit from knowing which pesticides need to be regulated on the basis of endocrine disruption. More importantly, the clearinghouse would help define future activities on ED pesticides by outlining available information and country experiences. For example, the need to find alternatives for certain ED pesticides might be informed by clearinghouse information that indicates widespread use or contamination, or lack of implementation of alternatives. Overall, the clearinghouse would provide a sensible one-stop location for the survey results and pave the way for further solutions.

¹¹ Case studies on exposure of fetuses and children to ED pesticides, particularly in developing and transition countries, would provide valuable information for regulators and other stakeholders. Children can be exposed in a number of ways, including through occupational use, parental use, household use or storage, public health use, reuse of pesticide containers, and environmental contamination.

¹² Countries could benefit a great deal from case studies on best practice replacement of ED pesticides with safer alternatives, especially ecosystem-based approaches to pest management. One source of information for ecosystem-based alternatives has already been approved by the Stockholm Convention COP6 for work on alternatives to endosulfan; UNEP/POPS/POPRC.8/INF/14/Rev.1;

<http://synergies.pops.int/2013COPsExCOPs/Documents/tabid/2915/language/en-US/Default.aspx>

- Needs assessment for regulation and substitution

Annex 1. Effects of ED pesticides

The recent UNEP/WHO report on endocrine disruptors¹³ notes associations or potential associations between pesticides and such adverse effects in humans as non-descended testicles, cryptorchidism, hypospadias, and decreased sperm production; prostate, breast, endometrial, ovarian and thyroid cancers; childhood leukemia and developmental neurotoxicity; longer menstrual cycles, younger age at menarche, uterine fibroids, endometriosis, increased risk of miscarriage and preterm deliveries; type 2 diabetes, and periodontal disease.

Adverse effects observed in animals include:

- fibroids in seals; in American alligators high plasma estradiol in females, depressed testosterone, altered structure of testis, reduced phallus, dramatic declines in juvenile recruitment; intersex frogs; thyroid disruption in fish; eggshell thinning and decreases in bird populations;
- in males: reduced semen quality, reduced number of Sertoli cells and gonocytes, and increased number of apoptotic germ cells in fetal testis; reduced anogenital distance, nipple retention, hypospadias including cleft phallus, cryptorchidism, reduced accessory sex organ weights, delayed preputial separation, abnormally small phallus, decreased testis weight, poorly organized testis, decreased plasma testosterone levels, glandular atrophy and chronic inflammation of prostate, reduced secretion and chronic inflammation of seminal vesicles, epididymal granulomas, agensis of prostate, spermatogenic granuloma, decreased sperm production, increased sperm head abnormalities, low ejaculated sperm count, abnormal morphology of seminiferous tubules, decreased fertility, reduction of erections during ex-copula penile reflex test, reduced spermatid number, epispadias, testicular and epididymal malformations, and regression of the Wolffian ducts;
- in females: reduced number of germ cells in fetal ovaries, increased post-implantation loss, increased plasma estradiol levels and decreased circulating estradiol, decreased progesterone, abnormal ovarian morphology with large number of polyovular follicles and polynuclear oocytes, increased atretic follicles, interrupted oestrous cycle, and regression of the Wolffian ducts;
- in both sexes: insulin resistance, immune suppression.

¹³ WHO, UNEP. 2012. State of the Science of Endocrine Disrupting Chemicals 2012. <http://www.who.int/ceh/publications/endocrine/en/>

Annex 2. Proposed elements of a report on EDCs that is targeted to developing countries and countries with economies in transition

This report would satisfy the element of the resolution which calls for *“timely updates to the 2012 report on the state of the science of endocrine-disrupting chemicals...with particular attention to the needs of developing countries and CEITs”* as well as *“recommending potential measures that could contribute to reductions in exposures to or the effects of endocrine-disrupting chemicals.”* The report could build on the referenced 2012 report, and provide a targeted focus on developing and transition countries.

Elements of this report could include:

- Description of where EDCs are found in developing and transition countries, including products, pesticides, and identities of substances;
- Survey of available information (e.g. bio-monitoring) regarding current levels of exposure to EDCs in developing countries and CEITs, and information gaps;
- Existing legislation and policies and gaps in measures to protect people and the environment from EDCs in developing countries and CEITs, especially women, workers, and children;
- Stakeholder needs on information regarding EDCs in products throughout their whole life-cycle including research carried out under the SAICM Chemicals in Products project;
- List of pesticides that are also EDCs and example measures to substitute them with safer and non-chemical alternatives (as pesticides are deliberately released into the environment and exposure to them is a major source of chemical exposure in developing countries);
- Examples of best practices in reducing the use of EDCs, including safer substitution, non-chemical alternatives and risk-management, if any; and
- Capacity needs for reducing the risks of EDCs in developing countries and CEITs.

Such a report would not only satisfy Action point 6(a), but several other related action points from the ICCM3 resolution, including Action point 6(b), 6(c) and 6(d). It is important to note that the EDC report focused on developing and transition countries would utilize existing information (including information from the 2012 UNEP – WHO report). Since the report would not be a scientific update to the UNEP – WHO 2012 State of Science report we do not believe an exhaustive expert consultation would be required. However, regional input would be helpful and important for the report’s coverage and relevance. Some of the authors of the 2012 report might be helpful in assembling the proposed report.

Annex 3. Endocrine-disrupting pesticides

Endocrine-disrupting pesticides listed in Annex III of the Rotterdam Convention (25 substances)

2,4,5-T and its salts and esters	Dieldrin	Monocrotophos
Alachlor	Dinoseb	Parathion
Aldicarb	EDB (1,2-dibromoethane)	Pentachlorophenol and its salts and esters
Aldrin	Endosulfan	Toxaphene (camphechlor)
Azinphos-methyl	HCH (mixed isomers)	Tributyl tin compounds
Chlordane	Heptachlor	Dustable powder formulations containing a combination of benomyl at or above 7%, carbofuran at or above 10% and thiram at or above 15%
Chlordimeform	Hexachlorobenzene	Methyl-parathion (Emulsifiable concentrates (EC) at or above 19.5% active ingredient and dusts at or above 1.5% active ingredient)
Chlorobenzilate	Lindane (gamma-HCH)	Phosphamidon (Soluble liquid formulations of the substance that exceed 1000 g active ingredient/l)
DDT		

Endocrine-disrupting pesticides listed in the Stockholm Convention (14 substances)

Aldrin	DDT	Hexachlorobenzene
Alpha hexachlorocyclohexane	Dieldrin	Lindane
Beta hexachlorocyclohexane	Endosulfan	Mirex
Chlordane	Endrin	Toxaphene
Chlordecone	Heptachlor	

Other endocrine-disrupting pesticides ^{14 15 16}
(228 substances)

2,4,5-T	Bupirimate	Cypermethrin
2,4-D	Butamiphos	Cyprodinil
2,4-DB	butylate	DDT
Acephate	Carbaryl	Deltamethrin
Acetochlor	Carbendazim	DBCP; dibromochloropropane
Acifluorfen-methyl	Carbofuran	Diazinon
Alachlor	Chlordane	Dichlorofen
Aldicarb	Chlordecone	Dichlorprop-P
Aldrin	Chlordimeform	Dichlorvos; DDVP
Allethrin; bioallethrin	Chlorfenvinphos	Dichlofenthion
Alpha-BHC; alpha-HCH	Chlormethoxyfen	Diclofop-methyl
Alpha-chlorohydrin	Chlornitrofen	Dicofol
Ametryn	Chlorobenzilate	Dieldrin
Amitraz	Chloropropylate	Difenoconazole
Amitrole	Chlorothalonil	Diflubenzuron
Anilophos	Chlorotoluron	Dimethoate
Arsenic and its compounds	Chloroxuron	Dimethomorph
Atrazine	Chlorphropham	Dinocap
Azinphos-methyl	Chlorpyrifos	Dinoseb and its salts
Bendiocarb	Chlorthal-dimethyl (DCPA)	Diquat dichloride
Benomyl	Clofentezine	Dimoxystrobin
Bentazone	Copper oxychloride	Dodemorph
Beta- HCH; beta-BCH	Copper sulphate	Diuron
Bifenthrin	Coumaphos	Endosulfan
Bifenox	Cyanazine	Endrin
Bitertanol	Cyanofenphos	Epichlorohydrin
Boric acid	Cyanophos	EPN
Bromacil	Cycloprthrin	Epoxiconazole
Bromophos	Cyfluthrin	EPTC
Bromoxynil	Cyhalothrin	Esfenvalerate

¹⁴ WHO, UNEP. 2012. State of the Science of Endocrine Disrupting Chemicals 2012.

<http://www.who.int/ceh/publications/endocrine/en/>

¹⁵ TEDX (2011). TEDX List of Potential Endocrine Disruptors. Paonia, CO, The Endocrine Disruption Exchange <http://www.endocrinedisruption.org/endocrine.TEDXList.overview.php>.

¹⁶ PAN List of Highly Hazardous Pesticides¹⁶, category Endocrine Disruptor, which is based on 'potential endocrine disruptor' according to EU criteria

Other endocrine-disrupting pesticides (continued)

Ethion	Ioxynil	Monocrotophos
Ethiozin	Iprodione	Myclobutanil
Ethylene dibromide; 1,2-dibromoethane	Isofenphos	Nabam
ethylene thiourea	Isoproturon	Nitrobenzene
Etofenprox; Ethofenprox	Isoxathion	Nitrofen
Etridiazole (Terrazole)	Kepone	Nuarimol
Fenarimol	Ketoconazole	Omethoate
Fenbuconazole	Lambda-cyhalothrin	O-phenylphenol
Fenchlorphos	Leptophos	Oryzalin
Fenhexamid	Lindane	Oxadiazon
Fenitrothion	Linuron	Oxamyl
Fenoxycarb	Malathion	Oxyfluorfen
Ferbam	Mancozeb	Paraquat dichloride
Fenthion	Maneb	Parathion
Fentin acetate; triphenyltin acetate	MCPA	Parathion-methyl
Fentin hydroxide; triphenyltin hydroxide	MCPB	Pendimethalin
Fenvalerate	Mecoprop	Pentachloronitrobenzene
Fipronil	Mefenacet	Pentachlorophenol, PCP
Fluazifop-butyl	Metam-sodium	Penconazole
Flucythrinate	Methiocarb	Pencycuron
Fludioxonil	Methomyl	Pendimethalin
Flufenacet	Methoprene	Permethrin
Fluvalinate	Methoxychlor	Phenothrin
Fonofos	Methyl bromide	Phenthoate
Glyphosate	Metiram	Phorate
Heptachlor	Metolachlor	Phosalone
Hexachlorobenzene	Metribuzin	Phosphamidon
Hexaconazole	Mevinphos	Picloram
Hexachlorocyclohexane	Mirex	Piperonyl butoxide
Imazalil	Molinate	Piperophos

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Other endocrine-disrupting pesticides (continued)

Pirimiphos-methyl	Pyrethrins	Thiourea
Pretilachlor	Pyrimethanil	Thiram
Prochloraz	Pyrinuron	Tolclofos-methyl
Procymidone	Pyriproxyfen	Toxaphene
Prodiamine	Quinalphos	Triadimefon
Profenofos	Quinoxifen	Triademenol
Profoxydim	Quintozene	Tribufos
Prometryn	Resmethrin	Tributyltin compounds
Propamocarb	Simazine	Trichlorfon
Propanil	Tebuconazole	Triflumazole
Propazine	Tepraloxydim	Trifluralin
Propiconazole	Terbutyrn	Triphenyltin
Propoxur	Tetramethrin	Vinclozolin
Propyzamide; (pronamide)	Thenylchlor	Zeta-cypermethrin
Prothiophos	Thiazopyr	Zineb
Pyrazoxyfen	Thiobencarb	Ziram