



Beyond 2020: Women and chemical safety

IPEN and Pesticide Action Network
January 2017

Introduction

The Strategic Approach to International Chemicals Management (SAICM) addresses significant health and environmental harms caused by chemical exposure and makes a global political commitment to reform how chemicals are produced and used in order to minimize those harms. Heads of State at the 2002 World Summit on Sustainable Development in Johannesburg called for the development of SAICM. While the agreement is not legally binding, its basic texts represent a consensus of Environment Ministers, Health Ministers and other delegates from more than one hundred governments who attended the first International Conference on Chemicals Management (ICCM1), held in Dubai, February 2006.

Chemicals impact women and men in different ways and through different routes. These differences have consequences that play out against the larger backdrop of issues related to gender (in)equality and sustainable development. As UNEP's Global Gender and Environment Outlook notes, *"Sustainable development will not advance, nor will environmental protection policies and actions be as effective as they need to be, if gender equality is not protected and enhanced."*¹ Despite the fact that women make up roughly half the population and chemical exposures are widespread; the gender aspects of chemical safety have been largely ignored.

Women and chemical safety agreements

The UN Universal Declaration of Human Rights and the Convention on the Elimination of All Forms of Discrimination Against Women commit governments to equal rights for women.^{2 3} However, several international agreements specifically link women's issues to environmental management in general and chemical safety in particular.

Rio Principle 20 states, *"Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development."*⁴ Years later in 2006, SAICM also included important aspects related to women in an agreement that intimately links chemical safety with sustainable development.

The SAICM Dubai Declaration commits governments to, *"work towards effective and efficient governance of chemicals management by means of transparency, public participation and accountability involving all sectors of society, in particular striving for the equal participation of women in chemicals*

¹ United Nations Environment Programme (2016) Global Gender and Environment Outlook: The Critical Issues, DEW/1970/NA <http://www.unep.org/gender/portals/24117/GGEO%20TRIFOLDER%20final.pdf>

² United Nations (1948) Universal declaration on human rights, <http://www.un.org/en/universal-declaration-human-rights/index.html>

³ <http://www.un.org/womenwatch/daw/cedaw/>

⁴ United Nations Conference on Environment and Development (1992) Rio Declaration on environment and development, <http://www.unep.org/documents.multilingual/default.asp?documentid=78&articleid=1163>

management.”⁵ SAICM’s Overarching Policy Strategy notes that, “in many countries some stakeholders, particularly women and indigenous communities, still do not participate in all aspects of decision-making related to the sound management of chemicals, a situation which needs to be addressed” and states the importance of public participation in decision-making, “featuring in particular a strengthened role for women.”⁶ Risk reduction measures need to be improved, “to prevent the adverse effects of chemicals on the health of children, pregnant women, fertile populations, the elderly, the poor, workers and other vulnerable groups and susceptible environments.”⁷ Finally, one of SAICM’s objectives is, “To ensure equal participation of women in decision-making on chemicals policy and management.”⁸

The Stockholm Convention preamble notes, “health concerns, especially in developing countries, resulting from local exposure to persistent organic pollutants, in particular impacts upon women and, through them, upon future generations.”⁹ The treaty obligates governments to, “consult their national stakeholders, including women’s groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.”¹⁰ The Stockholm Convention instructs Parties to promote and facilitate, “Development and implementation, especially for women, children and the least educated, of educational and public awareness programmes on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives.”¹¹

The Minamata Convention on Mercury preamble notes awareness of, “health concerns, especially in developing countries, resulting from exposure to mercury of vulnerable populations, especially women, children, and, through them, future generations.”¹² National Action Plans to address artisanal and small-scale gold mining include, “Strategies to prevent the exposure of vulnerable populations, particularly children and women of child-bearing age, especially pregnant women, to mercury used in artisanal and small-scale gold mining.”¹³

The 2011 Global Environment Facility (GEF) policy on gender mainstreaming includes a requirement that GEF partner agencies have established policies, strategies, or action plans that promote gender equality.¹⁴ The agency will to develop guidance on, “inclusion of gender aspects in the design of projects and on the monitoring and evaluation of gender dimensions in the context of its projects.”¹⁵

⁵ UNEP - WHO (2006) Dubai Declaration, para 18, Strategic Approach to International Chemicals Management http://www.saicm.org/index.php?option=com_content&view=article&id=73&Itemid=475

⁶ UNEP - WHO (2006) Overarching Policy Strategy, para 2, 9, Strategic Approach to International Chemicals Management http://www.saicm.org/index.php?option=com_content&view=article&id=73&Itemid=475

⁷ UNEP - WHO (2006) Overarching Policy Strategy, para 7, Strategic Approach to International Chemicals Management http://www.saicm.org/index.php?option=com_content&view=article&id=73&Itemid=475

⁸ UNEP - WHO (2006) Overarching Policy Strategy, para 16, Strategic Approach to International Chemicals Management http://www.saicm.org/index.php?option=com_content&view=article&id=73&Itemid=475

⁹ Stockholm Convention preamble,

<http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>

¹⁰ Stockholm Convention Article 7,

<http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>

¹¹ Stockholm Convention Article 10,

<http://chm.pops.int/TheConvention/Overview/TextoftheConvention/tabid/2232/Default.aspx>

¹² Minamata Convention on Mercury

http://www.mercuryconvention.org/Portals/11/documents/conventionText/Minamata%20Convention%20on%20Mercury_e.pdf

¹³ Minamata Convention on Mercury

http://www.mercuryconvention.org/Portals/11/documents/conventionText/Minamata%20Convention%20on%20Mercury_e.pdf

¹⁴ Global Environment Facility (2011) Mainstreaming Gender at the GEF

¹⁵ Global Environment Facility (2011) Mainstreaming Gender at the GEF

Basic elements of the relationship between women and chemical safety

Factors affecting women and chemical safety include these elements:

- **Lack of data:** Knowledge of exposure routes and the true impacts of chemical exposures on women are difficult to determine because gender-disaggregated data is thin or entirely absent. As a result, current exposure standards are usually based on an assumed average male height and body weight and this reduces protection for both women and children. In addition, without links to other gender data such as the number of women in certain occupations, linkages to certain health effects cannot be identified. Better understanding of gender-dependent hazards will improve how protective and preventive measures are designed and implemented.
- **Environment assessments of and activities on chemicals and wastes usually ignore gender aspects:** This disparity hides differences in gender susceptibility to chemical exposure. To achieve better outcomes from chemicals management measures, and awareness-raising and capacity-building activities, it is sometimes crucial to address men and women differently. For example, information workshops addressing households are often attended by the male head of the family, even though often the women should have the information first hand. This could lead to many recommendations not being implemented in the household (e.g. waste handling). Therefore, chemicals and waste projects should have a gender assessment before they start, gender sensitive indicators and activities, and a gender evaluation after they finish, to increase the effectiveness of the outcomes.
- **Different physiology affects exposure and impacts:** Women and men have different hormone systems that influence a whole host of body functions during development and as adults. Throughout their lives, women are exposed to numerous harmful chemicals that can be transferred across the placenta during fetal development and through breast milk to the nursing infant. Exposures to chemicals that dissolve in fat are especially relevant, as women tend to have higher fat content. Exposures during fetal development can cause lifelong harm and increase the risks of such harmful effects as preterm births, birth defects, childhood and adult diseases. Adverse effects can also be carried across multiple generations. A growing number of chemicals have been shown to exert multigenerational and transgenerational effects. Exposure to pregnant females not only impacts the offspring (F1) but also their offspring (F2) and even the subsequent generation (F3.)
- **Unique time periods of susceptibility:** Men and women have different time periods in which impacts of chemical exposure can be especially high. For women, these time periods include adolescence, pregnancy, lactation, and menopause.
- **Different types of occupational exposures:** Women and men both experience occupational exposures to chemicals, but these may differ based on the region, type of occupation, and access to information. For example, women working in agriculture in some countries can represent the majority of workers involved in pesticide spraying. In some countries, women working in rural areas are exposed to chemicals due to the traditional practice of burning agricultural stubble and waste in preparation for planting. Beauty salon workers are overwhelmingly women, and are often exposed to chemicals in the products they handle. Women are also exposed at home while using cleaning products, household pest control products, washing pesticide-contaminated clothing, the storage of pesticides and spray equipment in kitchens, or dealing with wastes. Women typically work at the lowest level in global production

systems. This feminization of poverty makes women more susceptible and vulnerable to toxic chemical exposure, putting their health at risk.

- **Exposures to chemicals in different types of consumer products:** Women use a different spectrum of consumer products than men. For example, women use substantially more personal care products than men and usually do house work using cleaning products containing chemicals. This and other differential use of products results in different types of chemical exposures.
- **Decision-making on environment and chemical safety issues is not equal:** Women generally have more limited decision-making power and this is consistent with the low number of parliament seats and higher-level government positions held by women, as well as decision-making at the household level. The role of women as educators, trainers, and decision-makers in addressing chemicals and waste problems is both underestimated and underutilized. There are wide disparities between women and men in access to education, resources, social protection, financing, capacity-building and training, and technical knowledge and skills. This creates different exposure scenarios, impacts empowerment, and undermines the development of gender responsive policies.

Women and SAICM issues of concern

Gender is highly relevant to all of SAICM's elements, but its importance can be illustrated with its connections to prominent issues of concern agreed by consensus over the past ten years.

Highly Hazardous Pesticides

Pesticides represent the largest chemical exposures in developing countries and gender is an important factor in exposure, health effects, and implications for food production. Gender aspects of pesticides and the broader topic of sustainable agriculture are highly relevant to the SAICM decision taken in 2015 at ICCM4 to address highly hazardous pesticides and achievement of Sustainable Development Goal 2.

UNEP's Global Gender and Environment Outlook notes that, although, "*Data on pesticide use by women and men in food production are incomplete and inconsistent*", "*There are gender differences in pesticide use, exposures, health outcomes and environmental impacts*," and that, "*Gender differences in the effects of chronic exposures to pesticides are related to the different physiologies of men and women. Overall, women are more biologically sensitive than men to many pesticides.*"¹⁶ The number of women working as pesticide applicators varies in different countries but in some countries, "*women make up 85% or more of the pesticide applicators on commercial farms and plantations, often working whilst pregnant or breastfeeding.*"¹⁷

Women are also uniquely exposed to pesticides even when they do not directly apply them. In Pakistan, where cotton is picked by women, a survey found that 100% of the women picking cotton 3-15 days after pesticides had been sprayed suffered acute pesticide poisoning symptoms.¹⁸ In Chile, in 1997, of the 120 reported pesticide poisonings, 110 were women, nearly all employed in the flower industry.¹⁹ Other routes

¹⁶ United Nations Environment Programme (2016) Global Gender and Environment Outlook: The Critical Issues, DEW/1970/NA <http://www.unep.org/gender/portals/24117/GGEO%20TRIFOLDER%20final.pdf>

¹⁷ Watts M (2013) Breast cancer, pesticides, and you. Pesticide Action Network Asia and the Pacific <http://www.panap.net/sites/default/files/Breast-cancer-pesticides-and-you.pdf>

¹⁸ Tahir S, Anwar T (2012) Assessment of pesticide exposure in female population living in cotton growing areas of Punjab, Pakistan. Bull Environ Contam Toxicol 89:1138-41.

¹⁹ Wesseling C, Parra M, Elgstrand K (1998) Fruit Production, Pesticides and the Health of Women Workers. International Development Cooperation Internal Report 4. Stockholm, National Institute for Working Life.

of exposure not generally taken into account in exposure assessments include weeding and thinning sprayed crops, picking tea-leaves, washing out the pesticide containers or washing pesticide-contaminated clothing.^{20 21}

The UNEP report notes that, *“Farmers’ decisions about adopting new technologies and strategies for food production are usually made within the context of households, where women and men typically have unequal power.”*²² It also notes the high environmental impact of high-input large-scale agriculture and supports use of agroecology approaches that include ecological, economic, and social dimensions as a way to support gender equality and reduce the negative impacts of agriculture.

The International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) was an intergovernmental process co-sponsored by FAO, GEF, UNDP, UNEP, UNESCO, the World Bank and WHO. Representatives from more than 100 countries participated. Among many topics, the IAASTD addressed the important role of women in agriculture and changes needed to ensure gender equality and sustainable agriculture.²³ The report concluded that pesticide exposure is a common health risk and that, *“In some countries (e.g., in SSA [Sub-Saharan Africa]) women are now in charge of tasks formerly performed only by men such as soil preparation, spraying and marketing. This requires women’s access to additional skills and presents new risks (e.g., health risks related to the unregulated use of chemicals, especially pesticides) to girls and women.”*²⁴ As a result, IAASTD recognized, *“that the largest proportion of rural women worldwide continues to face deteriorating health and work conditions, limited access to education and control over natural resources, including formal title to land, technology and credit, insecure employment and low income.”*²⁵

Lead in paint

Gender aspects are highly relevant to lead poisoning and the SAICM objective to eliminate lead paint by 2020. In 2009, ICCM2 created the Global Alliance to Eliminate Lead Paint (GAELP) with UNEP and WHO serving as a joint secretariat. In 2015, delegates at ICCM4 reaffirmed worldwide elimination of lead paint as a global priority issue.

The human fetus is the most vulnerable to the toxic effects of lead and a pregnant woman can transfer lead that has accumulated in her body to her developing child.²⁶ Lead is also transferred through breast milk when lead is present in a nursing mother.²⁷ WHO notes that, *“Exposure of pregnant women to high levels of lead can cause miscarriage, stillbirth, premature birth and low birth weight, as well as minor malformations.”*²⁸ Once lead enters a child’s blood stream through ingestion, inhalation, or across the

²⁰²⁰ United Nations Environment Programme (2016) Global Gender and Environment Outlook: The Critical Issues, DEW/1970/NA <http://www.unep.org/gender/portals/24117/GGEO%20TRIFOLDER%20final.pdf>

²¹ Watts MA. 2010. Pesticides: Sowing Poison, Growing Hunger Reaping Sorrow. 2nd Ed. Pesticide Action Network Asia and the Pacific, Penang.

²² United Nations Environment Programme (2016) Global Gender and Environment Outlook: The Critical Issues, DEW/1970/NA <http://www.unep.org/gender/portals/24117/GGEO%20TRIFOLDER%20final.pdf>

²³ United Nations Environment Programme (2008) International Assessment of Agricultural Knowledge, Science and Technology for Development <http://www.unep.org/dewa/Assessments/Ecosystems/IAASTD/tabid/105853/Defa>

²⁴ United Nations Environment Programme (2008) International Assessment of Agricultural Knowledge, Science and Technology for Development <http://www.unep.org/dewa/Assessments/Ecosystems/IAASTD/tabid/105853/Defa>

²⁵ United Nations Environment Programme (2008) International Assessment of Agricultural Knowledge, Science and Technology for Development <http://www.unep.org/dewa/Assessments/Ecosystems/IAASTD/tabid/105853/Defa>

²⁶ Bellinger, DC (2008) Very low lead exposures and children’s neurodevelopment. Current Opinion in Pediatrics, 2008. 20:172-177

²⁷ Bjorklund KL, Vahter M, Palm B, Grander M, Lignell S, Berglund M (2012) Metals and trace element concentrations in breast milk of first time healthy mothers: a biological monitoring study, Environ Health 11:92

²⁸ <http://www.who.int/mediacentre/factsheets/fs379/en/>

placenta, it has the potential to damage a number of biological systems and pathways. The primary target is the central nervous system and the brain, but low levels of lead can also affect the immune, reproductive and cardiovascular systems, the kidneys, and the skeleton.^{29 30} Lead is also categorized as an endocrine-disrupting chemical (EDC).³¹ According to WHO's fact sheet on Lead Poisoning and Health: "There is no known level of lead exposure that is considered safe."³²

Chemicals in products

Women are exposed to multiple chemicals during product manufacturing, use, and disposal. Some occupations involving chemicals have high proportions of women workers. For example, the textile industry is noted for its high chemical use and pollution and, "The majority of workers at various stages of the textile chain, from manufacturing to packing and retailing of the final products, are women. They are significantly exposed to the variety of chemicals present in clothing products."^{33 34} Different patterns of product use can also result in different potential chemical exposures. For example, women use more personal care products than men and a wide variety of chemicals found in these products raise health concerns. These include 1,4-dioxane, acrylates, carbon black, coal tar, diethanolamine, formaldehyde, and others.³⁵ However, information on these and other toxic chemicals is usually not disclosed and is not included on product labels, which makes women unaware of potential health hazards caused by toxic ingredients. Proper labeling and classification of chemicals is needed to help women make better choices and understand requirements for safe handling, storage, and disposal. Gender implications of chemical exposures from products also impact future generations. A study of pregnant women found that, certain PCBs, organochlorine pesticides, PFCs, phenols, PBDEs, phthalates, polycyclic aromatic hydrocarbons (PAHs) and perchlorate were detected in 99% - 100% of pregnant women.³⁶ IPEN studies of chemicals in products have revealed a wide variety of toxic metals in skin-lightening creams and other consumer products.^{37 38 39 40 41} Finally, in some countries women and children play dominant roles in waste collection, with potential exposures from chemicals in products and those released from burning.⁴²

Hazardous substances within the life cycle of electrical and electronic products

This SAICM emerging policy issue covers design, production and use, and end of life aspects of hazardous chemicals in electrical and electronic products. This is highly relevant to women, as they have played a prominent role in electronics manufacturing beginning in the early 20th century, and helped make

²⁹ World Health Organization, Childhood lead poisoning. 2010

³⁰ Needleman H (2004) Lead Poisoning. Annual Review of Medicine, 55: 209-222

³¹ Iavicoli I, Fontana L, Bergamaschi A (2009) The effects of metals as endocrine disruptors. Journal of Toxicology and Environmental Health-Part B-Critical Reviews, 12: 206-223

³² World Health Organization (2016) Lead poisoning and health.

<http://www.who.int/mediacentre/factsheets/fs379/en/>

³³ Caterbow A, Hausmann J (2016) Women and chemicals: The impact of hazardous chemicals on women,

http://www.wecf.eu/english/publications/2016/women_chemicals.php

³⁴ UNEP leads the chemicals in products project and has conducted a GEF project on "best practices for exchange of information on chemicals in textile products" in China. No public interest NGOs were invited to participate in the project and ironically, little information about it has been made available.

³⁵ www.safecosmetics.org/get-the-facts/chemicals-of-concern/

³⁶ Woodruff TJ, Zota AR, Schwartz JM (2011) Environmental chemicals in pregnant women in the United States: NHANES 2003 – 2004, Environ Health Perspect 119:878-885

³⁷ <http://ipen.org/site/toxics-products-overview>

³⁸ <http://ipen.org/documents/imeap-report-market-investigation-illegal-importation-mercury-containing-skin-whitening>

³⁹ <http://ipen.org/documents/ecowaste-coalition-imeap-poster-market-investigation-illegal-importation-mercury>

⁴⁰ <http://ipen.org/site/china-results>

⁴¹ <http://www.ipen.org/sites/default/files/documents/EARTH%20Hg%20in%20Whitening%20-%20Report.pdf>

⁴² Caterbow A, Hausmann J (2016) Women and chemicals: The impact of hazardous chemicals on women, http://www.wecf.eu/english/publications/2016/women_chemicals.php

it a mass production industry due to low wages. As an engineering wiki notes, “*The electronics industry was the largest employer of women in the United States by 1960.*”⁴³ The growth of the industry also included a rapid rise in toxic chemical use. As the American Public Health Association has noted, “*The manufacture of electrical and electronic products relies on and uses more than a thousand chemicals and other materials, many of which are known to be hazardous and lack comprehensive toxicological health and safety information due to weak regulatory policies.*”⁴⁴

In the US, an investigation of 32,000 worker deaths in IBM between 1969 and 2001, “*found excesses of brain, kidney, and pancreatic cancer, along with melanoma, in male manufacturing workers. Female workers had higher-than-expected numbers of deaths from kidney cancer, lymphoma, and leukemia.*”⁴⁵ The company subsequently tried to block publication of these results. Years later, another study found solvent exposure in women working in the electronics industry during the first trimester of pregnancy was significantly associated with spontaneous abortion.⁴⁶

In subsequent decades, the electronics industry moved to Latin America and Asia where it rapidly expanded into using complicated supply chains with numerous small sub-contractors – many of whom have even less capacity for chemicals management than large companies. In Asia, women became the prime labor force because the industry noted a need for cheap, patient, and obedient workers and presumed that young women would be, “*accustomed to life in a traditional patriarchal atmosphere and would have already learned to be respectful of authority.*”⁴⁷ By the mid-1970s, there were about one million workers in electronics assembly in Asia and 90% of them were women.⁴⁸ The industry has substantially grown since then, and two places that provide examples of its consequences for women are Taiwan and the Republic of Korea.

In the 1970s many international companies began electronics manufacturing in Taiwan. Young women joined the industry and subsequently suffered from occupational diseases. These include deaths due to trichloroethylene exposure at the Philco-Ford and Mitsumi factories.⁴⁹ In the 1990s, regulators found RCA had polluted groundwater with trichloroethylene, perchloroethylene, and other toxic chemicals. Studies of former workers and community residents found an increased risk of liver cancer and an increase in breast cancer.⁵⁰

In the Republic of Korea, an analysis of epidemiological data found evidence suggesting reproductive risks to women from semiconductor fabrication jobs including spontaneous abortion, congenital

⁴³ http://ethw.org/Women_and_Electrical_and_Electronics_Manufacturing

⁴⁴ American Public Health Association (2012) Improving Occupational and Environmental Health in the Global Electronics Industry, Policy Number 20124 <https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2014/07/21/08/43/improving-occupational-and-environmental-health-in-the-global-electronics-industry>

⁴⁵ Morris J (2015) A toxic legacy, Slate, 2 July 2015

http://www.slate.com/articles/business/moneybox/2015/07/toxic_substances_in_electronics_manufacturing_the_us_does_tragically_little.html

⁴⁶ Lipscomb JA, Fenster L, Wensch M, Shusterman D, Swan S (1991) Pregnancy outcomes in women potentially exposed to occupational solvents and women working in the electronics industry, J Occup Med 33:597-604

⁴⁷ Rana S (2013) Berkeley Journal of Gender, Law & Justice 15:272-311

<http://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?article=1166&context=bglj>

⁴⁸ Lim LY (1981) In: Dauber R, Cain ML, eds. Women and technological change in developing countries. Boulder, Colorado, Westview Press, 1981. 181-90. (AAAS Selected Symposium 53) <http://www.popline.org/node/385070>

⁴⁹ Lin YP (2012) From Philco, Mitsumi to RCA: Female electronic workers’ occupation diseases in Taiwan, East Journal <http://www.ym.edu.tw/eastsjournal/abstract.html>

⁵⁰ Sung TI, Chen PC, Lee LJH, Lin YP, Hsieh GY, Wang JD (2007) Increased standardized incidence ratio of breast cancer in female electronics workers, BMC Public Health 7:102

malformation, and reduced fertility.⁵¹ A subsequent examination of reproductive risks among female microelectronics workers aged 20 – 39 years old found a significantly higher risk for spontaneous abortion and menstrual aberration.⁵² A study of leukemia and non-Hodgkin lymphoma (NHL) cases from the Giheung Samsung plant reported to the Supporters for the Health and Rights of People in the Semiconductor Industry (SHARPs), found 17 sick workers with 11 of them women – all 30 years old or younger.⁵³ More than 300 cases of occupational diseases in electronics workers in the Republic of Korea have been documented and court or government decisions have linked some of the illnesses to working conditions.⁵⁴ So far, three women with leukemia, one woman with lymphoma, two women with aplastic anemia, and two women with breast cancer have all had their conditions linked to work in the electronics industry by court or government decisions.⁵⁵

The issue of women in electronics is an ongoing matter of concern due to the large use of chemicals and the high proportion of women workers. In Vietnam, most of the rapid economic growth is attributed to the electronics industry, which has expanded 78% per year in exports for the past four years.⁵⁶ The electronics industry makes up more than 20% of the GDP and now includes Canon, Intel, LG, Microsoft, Nokia, Panasonic, Samsung, and Sony.⁵⁷ Despite this large industry and the large female work force it employs (75% are women), current information, including the industry's occupational and/or its environmental impact, is lacking.

As noted above, in some countries women and children play dominant roles in waste collection, with potential exposures from chemicals in products and those released from burning. One example is the large number of women working on electronic waste (e-waste), which is produced globally in “*staggering quantities*”, estimated in 2014 to be 41.8 million tonnes.⁵⁸ The work includes burning cables, acid baths, breaking equipment open, and breaking apart soldered components. This results in a variety of toxic chemical exposures, especially in developing countries, “*where most informal and primitive e-waste recycling occurs, environmental exposure to lead, cadmium, chromium, polybrominated diphenyl ethers, polychlorinated biphenyls, and polycyclic aromatic hydrocarbons is prevalent at high concentrations in pregnant women and young children.*”⁵⁹ Adverse health effects from e-waste pollution, “*is believed to a significant factor in or near communities where informal recycling takes place.*”⁶⁰ Women exposed to

⁵¹ Kim MH, Kim H, Paek D (2014) The health impacts of semiconductor production: an epidemiologic review, *Int J Occup Environ Health* 20:94-114

⁵² Kim I, Kim MH, Lim S (2015) Reproductive Hazards Still Persist in the Microelectronics Industry: Increased Risk of Spontaneous Abortion and Menstrual Aberration among Female Workers in the Microelectronics Industry in South Korea, *PLoS One* doi: 10.1371/journal.pone.0123679

⁵³ Kim I, Kim HJ, Lim SY, Kong JO Leukemia and non-Hodgkin lymphoma in semiconductor industry workers in Korea (2012) *Int J Occup Environ Health* 18:147-153

⁵⁴ Personal communication from Supporters for the Health and Rights of People in the Semiconductor Industry (SHARPS)

⁵⁵ Personal communication from Supporters for the Health and Rights of People in the Semiconductor Industry (SHARPS)

⁵⁶ http://www.vietrade.gov.vn/en/index.php?option=com_content&view=article&id=2388:opportunities-and-challenges-for-vietnams-electronic-export&catid=270:vietnam-industry-news&Itemid=363

⁵⁷ <http://tuoitrenews.vn/business/29142/vietnams-electronics-industry-booming-with-bright-prospects-but-changes-needed>

⁵⁸ Heacock M, Kelly CB, Asante KA, Birnbaum LS, Bergman AL, Bruné MN, Buka I, Carpenter DO, Chen A, Huo X, Kamel M, Landrigan PJ, Magalini F, Diaz-Barriga F, Neira M, Omar M, Pascale A, Ruchirawat M, Sly L, Sly PD, Van den Berg M, Suk WA (2016) E-waste and harm to vulnerable populations: a growing global problem. *Environ Health Perspect* 124:550–555; <http://dx.doi.org/10.1289/ehp.1509699>

⁵⁹ Chen A, Dietrich KN, Huo X, Ho S (2010) Developmental Neurotoxicants in E-Waste: An Emerging Health Concern, *Environ Health Perspect* 119:431-438

⁶⁰ Heacock M, Kelly CB, Asante KA, Birnbaum LS, Bergman AL, Bruné MN, Buka I, Carpenter DO, Chen A, Huo X, Kamel M, Landrigan PJ, Magalini F, Diaz-Barriga F, Neira M, Omar M, Pascale A, Ruchirawat M, Sly L, Sly

toxicants contained in e-waste, “*may suffer from anemia, fetal toxicity, hormonal effects, menstrual cycle irregularities, endometriosis, autoimmune disorders, and cancers of the reproductive system.*”⁶¹

Nanotechnologies and manufactured nanomaterials

Like other types of substances, gender concerns with nanomaterials involve manufacturing, product use, and wastes.

Toxicity studies in animals indicate that nanomaterials used in consumer products can harm the female reproductive system. Titanium dioxide nanoparticles can cause ovarian dysfunction, affect genes regulating immune response, disrupt the normal balance of sex hormones and decrease fertility.⁶² In addition, many nanoparticles can cross the placenta where they can cause, “*altered organogenesis and morphology as well as defects in the reproductive and nervous systems of the offspring.*”⁶³

The number of people working in nanotechnology is uncertain but some estimate there are 400,000 workers worldwide with predictions of 6 million workers by 2020.⁶⁴ Workers have the highest exposure to nanomaterials, including through handling, cleanup, maintenance, and dealing with wastes.⁶⁵ The number of female workers in the industry is not known, but a well-known case of harm to workers involved women. In 2009, seven female workers were diagnosed with severe pulmonary fibrosis caused by polymer nanoparticles and two of the women died (aged 19 and 29.)^{66 67 68}

Poorly characterized nanomaterials are widely present in products used by women, including food additives, cosmetics, and many consumer products.^{69 70} For example, nano silica is an ingredient in food products, cooking pans, pesticides, and fertilizers.⁷¹ However, silica nanoparticles smaller than 100 nm

PD, Van den Berg M, Suk WA (2016) E-waste and harm to vulnerable populations: a growing global problem. *Environ Health Perspect* 124:550–555; <http://dx.doi.org/10.1289/ehp.1509699>

⁶¹ McAllister L, Magee A, Hale B (2014) Women, e-waste, and technological solutions to climate change, *Health and Human Rights Journal* 16:166-178 <https://cdn2.sph.harvard.edu/wp-content/uploads/sites/13/2014/06/McAllister1.pdf>

⁶² Sun J, Zhang Q, Wang Z, Yan B (2013) Effects of nanotoxicity on female reproductivity and fetal development in animals models, *Int J Mol Sci* 14:9319 – 9337 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3676785/>

⁶³ Sun J, Zhang Q, Wang Z, Yan B (2013) Effects of nanotoxicity on female reproductivity and fetal development in animals models, *Int J Mol Sci* 14:9319 - 9337

⁶⁴ <https://blogs.cdc.gov/niosh-science-blog/2013/12/09/nano-exp/>

⁶⁵ Senjen R, Foladori G, Azoulay D (2013). Social and Environmental Implications of Nanotechnology Development in the Asia Pacific Region. NTN (National Toxics Network Australia) / ReLANS (Latin American Nanotechnology and Society Network) / IPEN

<http://ipen.org/sites/default/files/documents/Social%20and%20Enviro%20Implications%20of%20Nano%20Development%20in%20Asia-Pacific.pdf>

⁶⁶ Song Y, Li X, Du X (2009) Exposure to nanoparticles is related to pleural effusion, pulmonary fibrosis and granuloma, *Eur Respir J* 34:559-567

⁶⁷ Sun J, Zhang Q, Wang Z, Yan B (2013) Effects of nanotoxicity on female reproductivity and fetal development in animals models, *Int J Mol Sci* 14:9319 - 9337

⁶⁸ <https://thepumphandle.wordpress.com/2009/08/21/case-report-nanoparticles-in-workers-lungs/>

⁶⁹ Senjen R, Foladori G, Azoulay D (2013). Social and Environmental Implications of Nanotechnology Development in the Asia Pacific Region. NTN (National Toxics Network Australia) / ReLANS (Latin American Nanotechnology and Society Network) / IPEN

<http://ipen.org/sites/default/files/documents/Social%20and%20Enviro%20Implications%20of%20Nano%20Development%20in%20Asia-Pacific.pdf>

⁷⁰ <http://www.ewg.org/skindeep/2007/08/25/hundreds-of-personal-care-products-contain-poorly-studied-nano-materials/>

⁷¹ <http://www.fromthelabbench.com/the-downside-of-nano-pregnancy-complications/>

accumulated in the fetal liver and fetal brain of pregnant mice, damaged the placenta, lowered uterine weights, and caused significantly higher rates of a miscarriage equivalent.⁷²

As noted above, in some countries women and children play dominant roles in waste collection, with potential exposures from chemicals in products and those released from burning.⁷³ This includes exposures from releases of nanomaterials. Carbon nanotubes present in textiles, batteries and other products can be released during normal wear or when burned and then inhaled or via the food chain.⁷⁴ Preliminary evidence suggests that nanomaterials in wastes may catalyze the formation of other pollutants such as PAHs and furans and undermine pollution control technology.⁷⁵

Endocrine-disrupting chemicals (EDCs)

EDCs are harmful to both men and women but distinct hormone systems result in gender-specific attributes. They affect mammary gland development and pathogenesis,⁷⁶ and the UNEP GGEO report acknowledged a “*strong connection between pesticides and breast cancer*”, and that “*Almost 100 pesticides have been identified as potentially contributing to increased risk of breast cancer, and of these at least 63 are known to have estrogenic effects in laboratory studies.*”⁷⁷ In women, “*EDCs can adversely affect the ovary, uterus, vagina, anterior pituitary, and/or steroid production, which can lead to reproductive disorders such as early puberty, infertility, abnormal cyclicity, premature ovarian failure/menopause, endometriosis, fibroids, and adverse pregnancy outcomes.*”⁷⁸ A special concern for exposures during pregnancy is that alterations in fetal programming events can predispose adults to chronic diseases. For example, altering estrogen action during fetal development can affect reproduction in adulthood and damage fertility.⁷⁹ The International Federation of Gynecology and Obstetrics notes that the global rise in the rate of non-communicable diseases includes increases in diseases and conditions related to the endocrine system such as preterm birth and low birth weight, early onset of breast

⁷² <http://www.fromthelabbench.com/the-downside-of-nano-pregnancy-complications/>

⁷³ Caterbow A, Hausmann J (2016) Women and chemicals: The impact of hazardous chemicals on women, http://www.wecf.eu/english/publications/2016/women_chemicals.php

⁷⁴ Senjen R, Foladori G, Azoulay D (2013). Social and Environmental Implications of Nanotechnology Development in the Asia Pacific Region. NTN (National Toxics Network Australia) / ReLANS (Latin American Nanotechnology and Society Network) / IPEN <http://ipen.org/sites/default/files/documents/Social%20and%20Enviro%20Implications%20of%20Nano%20Development%20in%20Asia-Pacific.pdf>

⁷⁵ Senjen R, Foladori G, Azoulay D (2013). Social and Environmental Implications of Nanotechnology Development in the Asia Pacific Region. NTN (National Toxics Network Australia) / ReLANS (Latin American Nanotechnology and Society Network) / IPEN <http://ipen.org/sites/default/files/documents/Social%20and%20Enviro%20Implications%20of%20Nano%20Development%20in%20Asia-Pacific.pdf>

⁷⁶ Watts MA (2007) *Pesticides and Breast Cancer: A Wake-Up Call*. Pesticide Action Network Asia and the Pacific, Penang.

⁷⁷ United Nations Environment Programme (2016) Global Gender and Environment Outlook: The Critical Issues, DEW/1970/NA <http://www.unep.org/gender/portals/24117/GGEO%20TRIFOLDER%20final.pdf>

⁷⁸ Gore AC, Chappell VA, Fenton SE, Flaws JA, Nadal A, Prins GS, Toppari J, Zoeller RT (2015) EDC-2: The Endocrine Society's Second Scientific Statement on Endocrine-Disrupting Chemicals, The Endocrine Society, ISSN Print 0163-769X ISSN Online 1945-7189 <https://www.endocrine.org/~media/endsociety/files/publications/scientific-statements/edc-2-scientific-statement.pdf?la=en>

⁷⁹ UNEP and WHO (2013) State of the science of endocrine disrupting chemicals – 2012, edited by Bergman A, Heindel JJ, Jobling S, Kidd KA, Zoeller RT, ISBN: 978-92-807-3274-0 (UNEP) and 978 92 4 150503 1 (WHO) <http://www.unep.org/chemicalsandwaste/hazardoussubstances/UNEPsWork/StateoftheScience/tabid/105913/Default.aspx>

development and others.⁸⁰ Estrogenic EDCs are associated with uterine fibroids, ovarian dysfunction, and reduced fertility.⁸¹ Bisphenol A – the building block of polycarbonate plastics – is linked to reduced egg quality and viability in women seeking fertility treatment.⁸² In the EU, a conservative estimate of the costs of female reproductive disorders attributable to EDCs is almost €1.5 billion annually, primarily due to fibroids and endometriosis.⁸³ Like chemicals in products, gender aspects of exposures to EDCs involve occupation, consumer products, waste management, education, and socio-economic status.

Occupational exposures to EDCs include agriculture, manufacturing facilities, and service jobs. Pesticide exposure in women in developing countries is significantly higher than recognized and in some countries, “*women make up 85% or more of the pesticide applicators on commercial farms and plantations, often working whilst pregnant or breastfeeding.*”⁸⁴ Pesticides in wide use such as atrazine, 2,4-D, chlorpyrifos, and glyphosate are considered to be EDCs along with vector control agents such as DDT.⁸⁵ Plastics manufacturing is one example of exposure to EDCs during production. In Canada, the plastics industry has the highest proportion of women workers at 37% and in the US, almost 30% of workers in the industry are women.⁸⁶ A case control study found that women in jobs with potentially high exposure to carcinogens and EDCs have an elevated breast cancer risk. These jobs included agriculture, automotive plastics manufacturing, food canning, and metalworking, with the risk of premenopausal breast cancer highest for automotive plastics and food canning.⁸⁷ Other studies have reported increased breast cancer risk in women working in plastics processing, rubber and plastics products production, and in occupations involving exposures to synthetic textile fibers.⁸⁸ Women firefighters may also be at higher risk for developing breast cancer due to their occupational exposures to carcinogenic chemicals and EDCs.⁸⁹ In some regions of the world, women comprise more than 90% of the workforce in the field of nursing. A national study of nurses in the US suggests that the duration and intensity of occupational exposures to chemicals, pharmaceuticals, and radiation is linked with serious health problems such as cancer, asthma,

⁸⁰ DiRenzo GC, Conry JA, Blake J, DeFrancesco MS, DeNicola N, Martin JN, McCue KA, Richmond D, Shah A, Sutton P, Woodruff TJ (2015) International Federation of Gynecology and Obstetrics opinion on reproductive health impacts of exposure to toxic environmental chemicals, International Journal of Gynecology and Obstetrics <http://dx.doi.org/10.1016/j.ijgo.2015> http://www.figo.org/sites/default/files/uploads/News/Final%20PDF_8462.pdf

⁸¹ Gore AC, Crews D, Doan LL, La Merrill M, Patisaul H, Zota A (2015) Introduction to endocrine disrupting chemicals: A guide for public interest organizations and policy-makers, Endocrine Society and IPEN <http://ipen.org/documents/introduction-endocrine-disrupting-chemicals-edcs>

⁸² Gore AC, Crews D, Doan LL, La Merrill M, Patisaul H, Zota A (2015) Introduction to endocrine disrupting chemicals: A guide for public interest organizations and policy-makers, Endocrine Society and IPEN <http://ipen.org/documents/introduction-endocrine-disrupting-chemicals-edcs>

⁸³ Hunt PA, Sathyanarayana S, Fowler PA, Trasande L (2016) Female reproductive disorders, diseases, and costs of exposure to endocrine disrupting chemicals in the European Union, J Clin Endocrinol Metab 101:1562-1570

⁸⁴ Watts M (2013) Breast cancer, pesticides, and you. Pesticide Action Network Asia and the Pacific <http://www.panap.net/sites/default/files/Breast-cancer-pesticides-and-you.pdf>

⁸⁵ Gore AC, Crews D, Doan LL, La Merrill M, Patisaul H, Zota A (2015) Introduction to endocrine disrupting chemicals: A guide for public interest organizations and policy-makers, Endocrine Society and IPEN <http://ipen.org/documents/introduction-endocrine-disrupting-chemicals-edcs>

⁸⁶ DeMatteo R, Keith MM, Brophy JT, Wordsworth A, Watterson AE, Beck M, Ford AR, Gilbertson M, Pharityal J, Rootham M, Scott DN (2012) Chemical exposures of women workers in the plastics industry with particular reference to breast cancer and reproductive hazards. New Solut 22:427-448

⁸⁷ Brophy JT, Keith MM, Watterson A, Park R, Gilbertson M, Maticka-Tyndale E, Beck M, Abu-Zahra H, Schneider K, Reinhartz A, CEmatteo R, Luginaah I (2012) Breast cancer risk in relation to occupations with exposure to carcinogens and endocrine disruptors: a Canadian case-control study. Environ Health 11:87 doi: 10.1186/1476-069X-11-87

⁸⁸ DeMatteo R, Keith MM, Brophy JT, Wordsworth A, Watterson AE, Beck M, Ford AR, Gilbertson M, Pharityal J, Rootham M, Scott DN (2012) Chemical exposures of women workers in the plastics industry with particular reference to breast cancer and reproductive hazards. New Solut 22:427-448

⁸⁹ <http://www.silentspring.org/research-area/women-firefighters-biomonitoring-study>

miscarriages, and children's birth defects.⁹⁰ EDCs such as phthalates, brominated flame retardants, and bisphenol A are commonly used in plastics manufacturing. Service jobs also expose women to EDCs. For example, nail salon workers are overwhelmingly women and their work involves exposure to a number of toxic chemicals including EDCs such as phthalates, formaldehyde, and toluene.⁹¹ A study of the industry in California found 59% - 80% of nail salons are run by Vietnamese women, raising concerns about socio-cultural obstacles to worker safety, along with a sizeable proportion of women reporting health problems after they began working in the industry.⁹² Many other occupations involving women also result in exposure to EDCs.⁹³

EDCs are widely present in products used by women including cosmetics, cleaning products, household pesticides, personal care products, and many consumer products.⁹⁴ Known or potential EDCs in these products include galaxolide, cyclic methyl siloxanes, parabens, phthalates, and metals.⁹⁵ Usually, these product ingredients are not disclosed as EDCs or potential EDCs. Exposure results directly from product use and/or release of the chemicals and settling into dust or carpets and subsequent ingestion.⁹⁶ Even when only a small number of EDCs are considered, they are present in a myriad of products. Measurements of EDCs in 213 consumer products found phthalates in a vinyl pillow protector, diapers, tub and tile cleaner, dish liquid, laundry bleach, stain remover, hand sanitizer, hand soap, bar soap, body lotion, shampoo, conditioner, shaving cream, face lotion, facial tissues, deodorant, foundation, lipstick, lip balm, shower curtain, car interior cleaner, car air freshener, dryer sheets, polish/wax, hair spray, perfume, body wash and nail polish.⁹⁷ Alkylphenols were found in a vinyl pillow protector, diapers, surface cleaner, tube and tile cleaner, laundry bleach, body lotion, glass and floor cleaners, laundry detergent, bar soap, shampoo, shaving cream, face lotion, toothpaste, lip balm, foundation, lipstick, and mascara.⁹⁸ Parabens were found in hand soap, body lotion, shampoo, conditioner, shaving cream, face lotion, facial cleanser, foundation, lipstick, mascara, hair spray, and sunscreen.⁹⁹ A database of cosmetics ingredients made using ingredient labels and scientific and industry literature allows consumers to search for EDCs and other chemicals in personal care products.¹⁰⁰

⁹⁰ <http://www.massnurses.org/health-and-safety/articles/chemical-exposures/p/openItem/1250>

⁹¹ Ford AR (2014) Overexposed, underinformed: Nail salon workers and hazards to their health; a review of the literature, National Networks on Environments and Women's Health
<http://www.cwhn.ca/sites/default/files/lit%20review%20Jan%202015.pdf>

⁹² Quach T, Nguyen KD, Doan-Billings PA, Okahara L, Fac C, Reynolds P (2008) A preliminary survey of Vietnamese nail salon workers in Alameda County, California. *J Community Health* 33: 336-343

⁹³ Engel C, Rasanayagam S (2015) Working women and breast cancer: The state of the evidence, Breast Cancer Fund <http://www.breastcancerfund.org/assets/pdfs/publications/working-women-and-breast-cancer.pdf>

⁹⁴ Gore AC, Crews D, Doan LL, La Merrill M, Patisaul H, Zota A (2015) Introduction to endocrine disrupting chemicals: A guide for public interest organizations and policy-makers, Endocrine Society and IPEN
<http://ipen.org/documents/introduction-endocrine-disrupting-chemicals-edcs>

⁹⁵ UNEP and WHO (2013) State of the science of endocrine disrupting chemicals – 2012, edited by Bergman A, Heindel JJ, Jobling S, Kidd KA, Zoeller RT, ISBN: 978-92-807-3274-0 (UNEP) and 978 92 4 150503 1 (WHO)
<http://www.unep.org/chemicalsandwaste/hazardoussubstances/UNEPsWork/StateoftheScience/tabid/105913/Default.aspx>

⁹⁶ Gore AC, Crews D, Doan LL, La Merrill M, Patisaul H, Zota A (2015) Introduction to endocrine disrupting chemicals: A guide for public interest organizations and policy-makers, Endocrine Society and IPEN
<http://ipen.org/documents/introduction-endocrine-disrupting-chemicals-edcs>

⁹⁷ Dodson RE, Nishioka M, Standley LJ, Perovich LJ, Brody JG, Rudel RA (2012) Endocrine disruptors and asthma-associated chemicals in consumer products. *Environmental Health Perspectives* 120:935–943

⁹⁸ Dodson RE, Nishioka M, Standley LJ, Perovich LJ, Brody JG, Rudel RA (2012) Endocrine disruptors and asthma-associated chemicals in consumer products. *Environmental Health Perspectives* 120:935–943

⁹⁹ Dodson RE, Nishioka M, Standley LJ, Perovich LJ, Brody JG, Rudel RA (2012) Endocrine disruptors and asthma-associated chemicals in consumer products. *Environmental Health Perspectives* 120:935–943

¹⁰⁰ <http://www.ewg.org/skindeep/>

Environmentally persistent pharmaceutical pollutants

The SAICM emerging policy issue on this topic focuses on environmentally persistent substances, but the broader issue of pharmaceutical pollution is a global concern. Measurements of pharmaceutical pollutants in 71 countries revealed 631 different substances (or their metabolites) including antibiotics, non-steroidal anti-inflammatory drugs, analgesics, lipid-lowering drugs, estrogens, and others.¹⁰¹ Recently, the UN General Assembly held a high-level meeting to deal with drug-resistant bacteria and all 193 Member States agreed to combat proliferation of drug-resistant bacteria.¹⁰² Pharmaceutical pollution is a key driver of antibiotic resistance, with concerns raised as resistant bacteria not only proliferate in sewage treatment plants, but actually transfer and disperse antibiotic resistance to bacteria in the environment.^{103 104} Sources of pharmaceutical pollution include drug manufacturing, disposal from households, hospitals, and nursing homes, large-scale livestock or poultry operations using hormones and/or antibiotics, and excretion via urine or feces into sewage treatment plants.^{105 106 107 108} Pharmaceutical pollution contaminates drinking water sources. A 2008 study detected pharmaceutical contamination in drinking water sources serving 41 million people in 24 major metropolitan areas in the US, including antibiotics, anticonvulsants, and mood stabilizing drugs.¹⁰⁹

Concerns around exposure to pharmaceutical pollutants in women include chemical exposures during development, exposures to chemical mixtures, chemical exposures in women of reproductive age, and the fact that some pharmaceutical pollutants, “*are prohibited from prescription to pregnant women or children.*”¹¹⁰ Pharmaceuticals used by women can also impact the environment. The synthetic steroid estrogen, EE2, used in birth control pills, is resistant to removal in sewage treatment plants and accumulates in sewage sludge.¹¹¹ Estrogen and synthetic estrogens from birth control pills or

¹⁰¹ Murdoch K (2015) Pharmaceutical pollution in the environment: Issues for Australia, New Zealand and Pacific Island countries, National Toxics Network, <http://www.ntn.org.au/wp/wp-content/uploads/2015/05/NTN-Pharmaceutical-Pollution-in-the-Environment-2015-05.pdf>

¹⁰² Holpuch A (2016) UN meeting tackles the ‘fundamental threat’ of antibiotic-resistant superbugs, Guardian UK, 21 September 2016 <https://www.theguardian.com/society/2016/sep/20/un-declaration-antibiotic-drug-resistance>

¹⁰³ Olena A (2013) Resistant wastewater, The Scientist, 18 December 2013, <http://www.the-scientist.com/?articles.view/articleNo/38730/title/Resistant-Wastewater/>

¹⁰⁴ Luo Y, Yang F, Mathieu J, Mao D, Wang Q, Alvarez PJJ (2014) Proliferation of multidrug-resistant New Delhi metallo-Beta-lactamase genes in municipal wastewater treatment plants in Northern China, Environ Sci Technol Lett 1:26 - 30

¹⁰⁵ UNEP (2015) Nomination for a new emerging policy issue: environmentally persistent pharmaceutical pollutants, 4th International Conference on Chemicals Management, SAICM/ICCM.4/INF/15

¹⁰⁶ http://www.health.harvard.edu/newsletter_article/drugs-in-the-water

¹⁰⁷ Murdoch K (2015) Pharmaceutical pollution in the environment: Issues for Australia, New Zealand and Pacific Island countries, National Toxics Network, <http://www.ntn.org.au/wp/wp-content/uploads/2015/05/NTN-Pharmaceutical-Pollution-in-the-Environment-2015-05.pdf>

¹⁰⁸ European Public Health Alliance (2016) Drug resistance through the back door: How the pharmaceutical industry is fueling the rise of superbugs through pollution in its supply chains, http://epha.org/wp-content/uploads/2016/08/DRUG-RESISTANCE-THROUGH-THE-BACK-DOOR_WEB.pdf

¹⁰⁹ Donn J., et al. “An AP Investigation: Pharmaceuticals found in drinking water.” available at http://hosted.ap.org/specials/interactives/pharmawater_site/index.html

¹¹⁰ UNEP (2015) Nomination for a new emerging policy issue: environmentally persistent pharmaceutical pollutants, 4th International Conference on Chemicals Management, SAICM/ICCM.4/INF/15

¹¹¹ Murdoch K (2015) Pharmaceutical pollution in the environment: Issues for Australia, New Zealand and Pacific Island countries, National Toxics Network, <http://www.ntn.org.au/wp/wp-content/uploads/2015/05/NTN-Pharmaceutical-Pollution-in-the-Environment-2015-05.pdf>

postmenopausal hormone treatment can feminize male fish and result in changed sex ratios and intersex fish, and even cause reproductive failure in fish and collapse of populations.^{112 113}

> Outcomes to address the issue of women and chemical safety

Make women and chemical safety a high-level issue of concern

1. A multi-stakeholder women and chemical safety working group is established by 2020 to develop recommendations for actions on women and chemical safety that are included in workplans guiding SAICM emerging policy issues and issues of concern.
2. Female Ministers of Environment, Health, and Agriculture, in collaboration with relevant stakeholders, develop a report for SAICM on women and chemical safety for release in 2020 that includes case studies and concerns from all UN regions.
3. Female Ministers of Environment, Health, and Agriculture make a ministerial declaration on women and chemical safety in 2020 that springs from the findings and recommendations of their report and is consistent with the needs and strategies outlined in the SAICM agreement.

Address women and chemical safety as an integrated component in all IOMC and national projects

1. Develop gender guidelines for sound chemicals and waste management and agriculture in all IOMC and national projects by 2020. Existing gender guidelines could serve as the baseline, but do not currently address specific aspects of chemicals and wastes and the differences of their implications in women and men, and thus need to be expounded upon.
2. Donors and IOMC organizations require gender assessments, collection of sex-disaggregated data, and gender trainings for involved staff and project participants for all chemicals, waste, and agriculture projects by 2020.
3. Donors and IOMC organizations develop quantitative and qualitative gender and social class indicators for both policy and projects on chemicals, waste, and agriculture by 2020 to better understand gender and social class implications related to chemicals and waste topics, which will further lead to improved conditions for women and men equally, and empower them to play an active role as agents of change.
4. Donors and IOMC organizations require a section about gender-related activities and outcomes of the project in all chemicals, wastes, and agriculture projects by 2020.
5. Donors and IOMC organizations make all gender-disaggregated data retrieved in all projects publicly available beginning in 2022, to increase the protection of human health and to stimulate further scientific research.

¹¹² http://www.health.harvard.edu/newsletter_article/drugs-in-the-water

¹¹³ Murdoch K (2015) Pharmaceutical pollution in the environment: Issues for Australia, New Zealand and Pacific Island countries, National Toxics Network, <http://www.ntn.org.au/wp/wp-content/uploads/2015/05/NTN-Pharmaceutical-Pollution-in-the-Environment-2015-05.pdf>