Global Sound Management of Chemicals: A Developing Country Perspective from Sierra Leone

Dr. Thomas B. R. Yormah, Associate Professor
Department of Chemistry, Fourah Bay College, University of Sierra Leone.

Thomas Yormah served as Sierra Leone’s first representative on the first ever Persistent Organic Pollutants Review Committee (POPRC) for three (3) years (2005-2008). The high point of that membership was as Chairman of the PFOS Alternatives and Substitution Inter-Sessional Working Group; PFOS is acronym for perfluorooctane sulfonic acid, which is a POP used widely as flame retardants in electronics and construction industry. He attended POPRC6 as a guest scientist in 2009 where he presented the final report of his Inter-sessional Working Group. (See “Guidance on alternatives to perfluorooctane sulfonic acid and its derivatives – 2011”). This writer currently teaches a chemicals management module titled “Chemicals and the Environment” to undergraduate Chemistry students at Fourah Bay College, University of Sierra Leone. It was after Sierra Leone’s term on the POPRC had ended, and this writer was no longer a member of that body, that he was asked to do a piece - a Success Story - from the Developing Country perspective of the achievements of the POPRC. The requested story was to be included in a booklet that showcases the success of UNEP’s Stockholm Convention during its first 10 years and was intended to coincide with the recently held Rio+20 Meeting. His story, “Persistent Organic Pollutants Review Committee: the (10-Year) Success Story,” which can also be found on pages 25 - 29 of Success Stories: Stockholm Convention 2001-2011 at the following website: http://chm.pops.int/Convention/Media/Publications/tabid/506/Default.aspx is reproduced below (courtesy of UNEP’s Stockholm Convention). The following introduction helps provide a context for the re-produced article. Dr. Yormah holds undergraduate and postgraduate degrees from Fourah Bay College, University of Sierra Leone, and the University of Birmingham, UK.

Introduction

Chemicals have always been and will continue to be in the vanguard of the battle to achieve social and economic development. However, environmental pollution resulting from the discharge of toxic chemicals generated from anthropogenic sources in the train of industrialisation remains the biggest challenge posed by development. The chemicals-led development fronts include:

• Health and Sanitation—as drugs (including anaesthetics), food supplements, as control agents of disease vectors (such as mosquitoes, black flies that cause river blindness,) etc., in water purification, etc.
• Food Production—as fertilisers, weed and pest control agents (in farms and post-harvest barns/silos), as feed concentrates for fattening farm and domestic animals,
• Food Processing—as culinary/cooking aids in food preservation, flavouring, colouring, meat tenderisers, etc.
• Construction Industry—as wood/timber preservatives, in corrosion/rust treatment, as fire/flame retardants, termite control agents, in clearing drains and other water conduits,
• Cleaning Industry—as soaps, detergents, stain removing agents, dry cleaning liquids,
• Garment Industry—as water repellents in raingear, flame retardants impregnated into clothing, etc.
• Refrigeration/Cooling Industry—as refrigerants in refrigerators, freezers, air conditioners, etc.
• Transportation Industry—as petroleum fuels and lubricants in land, sea and air vehicles, etc.
• Energy Industry—as fossil fuels in thermal generators, nuclear fuels in nuclear reactors, fuels and oxidants in electrochemical and fuel cells, etc.
• Cosmetics Industry—almost all cosmetics products are either natural or artificial chemicals

In fact there is hardly any aspect of human existence that is not supported one way or the other by chemicals. Chemicals are indeed a vital part of our daily lives. The food we eat, the water we drink, the air we breathe, the alcohol and other beverages we consume are all essentially chemicals.

The foregoing pervasive usefulness of chemicals has led to an improvement in life expectancy (resulting from gains in fighting disease and both nutrition and calorie hunger) and comfortable life styles in travel, work ambiance, personal hygiene, etc. not enjoyed by our great forebears, who essentially were foragers. Yes, indeed, there are many members of our present generation that are still foragers, especially in Africa and other parts of the developing world, but this is mainly as a result of the way we have mismanaged our development process. By and large, humanity is today in a much better development station than our ancestors were, and the world as a whole has come a very long way in the development stride as a result of the successful deployment of chemicals. It has, however, become evident that this chemicals-induced and -catalysed development has been achieved at a price. It is to be noted that our forebears lived in harmony with their environment to the extent that whatever impact they had on the environment was transient and reversible. This means that the natural environment was always able to heal or nullify any impact humans made on it. With the current level of technological attainment brought about by our successful development stride, present day humans are now capable of making, and do make, more permanent impacts on the environment.

Alongside their immense benefits, chemicals have the potential to cause great harm to humans and to the environment, largely through their misuse. The disturbing use of chemicals as fish, rodent and bird poisons in the control and/or hunting and harvesting of these animals; of PCBs (contained in transformer oils) as cooking oils; phenol-based cosmetic creams as skin bleaching agents; of sudan and non-approved dyes to colour foods to improve their consumption appeal are a few examples of the misuse of chemicals. The indiscriminate and non-targeted application of pesticides and nonstrategic use of fertilisers are other worrying examples of misuse of chemicals.

The ugly manifestation of this misuse of chemicals is evident in the emergence and frequent occurrence of malignancies, birth defects, neurological and other strange diseases that have posed yet-to-conquer challenges to conventional and even traditional medicine. There is also evidence of the wiping out of rare and valuable biotic species through the
reckless use of chemicals, resulting in the depletion of biodiversity. The accidental release of very harmful chemicals leading to the death of humans, other mammals and other lower living organisms as occurred in the 1984 Bhopal, India chemical disaster (see www.corrosion-doctors.org/Pollution/htm is another worrying complication in the deployment of chemicals for development. These and countless other collateral damages arising from the deployment of chemicals have necessitated the regulation of chemicals throughout their life cycles, from production to disposal.

The global effort to manage the production, transportation, use and disposal of chemicals is coordinated and spearheaded by a branch of the United Nations Environment Programme (UNEP) called Strategic Approach to International Chemicals Management (SAICM), whose establishment was inspired by Chapter 19 of Agenda 21 (a core product of United Nations Conference on Environment and Development held in Rio de Janeiro, Brazil in 1992) and has its philosophy embedded in the 2006 Dubai Declaration on International Chemicals Management. SAICM is essentially a policy framework to foster the sound management of chemicals. (See www.saicm.org for more details).

The regulation of chemicals is achieved through chemicals-related global platforms called Multilateral Environmental Agreements (MEAs) that impose obligations and responsibilities on Parties to these agreements. The main chemicals related MEAs are: The Stockholm Convention (see www.pops.int); The Vienna Convention for the Protection of the Ozone Layer (see www.ozone.unep/pdfs/viennaconvention2002.pdf or www.ozone.unep.org) and the subsequent Montreal Protocol on Substances that Deplete the Ozone Layer (see www.ozone.unep.org/new_site/en/montreal_protocol.php; The Rotterdam Convention on the Prior Informed Consent Procedures for Certain Hazardous Chemicals and Pesticides in International Trade (PIC) – which aims to promote shared responsibilities in relation to the importation of hazardous chemicals by promoting open exchange of information and calling on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans (see www.pic.int); and The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal with the aim of reducing the movements of hazardous wastes between nations, and specifically to prevent the transfer of hazardous wastes from developed to less developed countries. This Convention is also intended to minimize the amount and toxicity of wastes generated, to ensure their environmentally sound management as closely as possible to the source of generation, and to assist Least Developed Countries (LCDs) in the environmentally sound management of the hazardous and other wastes they generate (see www.basel.int). As can be expected, considerable effort is directed at tapping the benefits that are derived from enhancing the synergies among these chemicals-management related MEAs. Most MEAs also provide empowerment by building the capacities of less able Parties to enable them to live up to their agreed obligations and responsibilities.

The Stockholm Convention is the MEA that deals exclusively with the management of a set of chemicals called Persistent Organic Pollutants (POPs). This name, which may sound frightening to the uninitiated chemist, is almost self-explanatory; it means, a priori, that these
chemicals are persistent organic compounds that are pollutants, i.e., undesirable in the environment. A more detailed profile of these chemicals is as follows:

- **Persistence:** Normally, all chemical substances—like most matter—eventually succumb to biodegradation within a reasonable time frame. Were this not the case, we humans would have long become buried under the weight of our own wastes. Technological advancement has, however, led to the production of chemicals that, to a very large extent, resist biodegradation. These chemicals remain unchanged for long periods in the environment, representing a major threat to the environment and humans long after they have ceased to be necessary. The working technical definition of persistence can be found in the text of the Stockholm Convention at the following website: [www.pops.int](http://www.pops.int).

- **Bioaccumulation:** This means that these chemicals, because of their persistence, remain unchanged and multiply in concentration at higher trophic levels as they move along the food chain from plants, through herbivores to carnivores all the way to omnivores such as humans. They defy digestion and degradation; and because they are mostly fat soluble, they are deposited intact in fatty tissues without being excreted, unlike most other ingested substances. The level of accumulation along the food chain that characterises a POP is defined in the Stockholm Convention text ([www.pops.int](http://www.pops.int)).

- **Subject to Long Range Trans-boundary Transport:** POPs are invariably volatile organic compounds. This means that they are of low molecular mass and are easily vaporised, become air-borne and thereby become agents of air transport during wind storms, tornados, hurricanes or convection air currents. This makes them present at locations very far away from their places of original release.

- **Toxicity:** POPs are invariably toxic to humans and/or other living organisms present in the environment.

Existing and/or newly produced chemicals that exhibit the foregoing profile/characteristics are declared as POPs and are regulated by either:

- Prohibition and/or elimination of production and use—these are classified as **Annex A POPs**
- Restriction of production and use—**Annex B POPs**
- Monitoring, reduction or elimination of release of chemicals listed in **Annex C**. Annex C POPs are unintentionally-produced POPs from anthropogenic sources such as those present in the smoke generated by the burning of garbage in dump sites.

The global body that does the scientific screening and characterisation of nominated chemicals and recommends their classification as POPs or otherwise is the Persistent Organic Pollutant Review Committee (POPRC), based in the Stockholm Convention Secretariat at Environment House in Geneva, Switzerland.
Notes

1. “Guidance on alternatives to perfluorooctane sulfonic acid and its derivatives – 2011.” (see UNEP/POPS/POPRC.6/13/Add.3/Rev.1)


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PERSISTENT ORGANIC POLLUTANTS REVIEW COMMITTEE: THE (10-YEAR) SUCCESS STORY

There is now no gainsaying or denial that science and technology are key drivers of social and economic development at all fronts. It is also now clear that the division of the globe into wealthy and developed nations (mostly of the northern hemisphere) and poor and yet-to-develop nations (mostly of the southern hemisphere) is essentially a science and technology
divide. One of the prime technologies that have been and continue to be in the vanguard of our present science and technology-led development are chemicals.

The deployment of chemicals at various development fronts has led to conspicuous positive achievements in all spheres of human endeavor. However, as with all technologies, such chemical development has also resulted in very negative impacts, mostly in the health and environmental arenas, as first highlighted by the author Rachel Carson in her classic *Silent Spring*.\(^1\)

It is against this background that the need to regulate the production and use of chemicals was conceived.

A set of chemicals whose deployment has raised the most disturbing health and environment concerns are those that have been generically referred to as Persistent Organic Pollutants (POPs). These have been profiled based on key health and environmental indicators, namely: persistence, bioaccumulation, potential for long-range environmental transport and adverse effects such as human and environmental toxicity. Those properties are together known to have the most potent adverse impact on biotic life and the environment.

The management of those sets of chemicals falls under the purview of the Stockholm Convention on Persistent Organic Pollutants (POPs), which must ensure that chemicals that meet the characteristics of POPs are managed according to an agreed regime by all Parties to the convention.

This management regime is based on the listing of POPs chemicals in one of three annexes: Annex A–Elimination; Annex B–Restriction; Annex C–Unintentionally released POPs.

When the Stockholm Convention on POPs was first established, 12 notorious chemicals which, by their use profiles, had already established themselves as POPs were immediately listed in Annexes A, B, or C to the Convention. It was however accepted that future advancements in technology were likely to unmask other chemicals already in use and to also lead to the production and use of new chemicals that possess POPs characteristics. To address this emerging challenge, the POPs Review Committee (POPRC) was established and was charged with the responsibility of professionally characterizing and assessing new chemicals with a view to determining whether or not they possess POPs characteristics and therefore need to be managed under the prescription of the Stockholm Convention. The POPs Review Committee—popularly referred to as POPRC—was given a modus operandi spelt out in the Convention text (which in essence became its constitution) and charged to go to work to rid the world of “dirty chemicals”.

At the 1\(^{st}\) meeting of the POPRC held from 7 to 11 November 2005, there were 5 chemicals, namely, chloredecone, hexabromobiphenyl (HBB), commercial pentabromodiphenyl ether (c-pentaBDE), perfluorooctane sulfonic acid (PFOS) and lindane (\(\gamma\)-hexachlorohexane or \(\gamma\)-HCH) on the table for assessment. Lindane was nominated by Mexico, PFOS was nominated by Sweden, c-pentaBDE was nominated by Norway, and the other two were nominated by the European Union. The task of the POPRC was to collate and synthesize the scientific evidence against these chemicals and thereby establish cases for their listing under Annexes A, B or C or otherwise to “exonerate” them— as required by the Risk Profile process in the modus operandi. The associated assignment was to work out a Risk Management regime for Parties likely to be affected by the regulation of these chemicals.
At the 2nd meeting of the POPRC (6–10 November 2006), another 5 chemicals, namely, α-hexachlorocyclohexane (or alpha-HCH), β-hexachlorocyclohexane (or beta-HCH), commercial octabromodiphenyl ether (or c-octaBDE), pentachlorobenzene, and short-chained chlorinated paraffins (SCCP) were on the table for assessment. Alpha- and beta-HCH were nominated by Mexico and the other three were nominated by the European Union. The POPRC worked intensively with some Contact Groups meeting late into the night, followed by pre-plenary morning meetings. Several Plenary sessions ran late and had to be conducted in English only.

After the 3rd meeting of the POPRC (19–23 November 2007), the Committee sent recommendations to the Conference of the Parties (COP) to consider listing 9 out of the 10 chemicals mentioned above; the assessment of SCCP was carried over to POPRC4. These 9 chemicals were listed as the new POPs at COP4 (the 4th Meeting of the Conference of the Parties, 4–8 May 2009).

It can be deduced from the foregoing that the POPRC, working at break-neck pace, achieved phenomenal successes, but it was not all plain sailing.

As the first crop of POPRC members, we were essentially the trial-blazers (or guinea pigs, if you like) that tested the validity of the application of the Convention text to the chemicals' review process, and naturally we came up against a number of challenges. Our efforts to address these challenges will hopefully serve posterity in removing the pot-holes from and thereby smoothing out the review process. The following gives a highlight of the early challenges and the solutions proffered:

• Early in the deliberations it became evident that the working definitions of bio-accumulation and bio-magnification needed to be further clarified. The POPRC member from Japan, Professor Masaru Kitano, an expert in this field of research, was given the task of fine-tuning those definitions, which he did satisfactorily.

• The issue of listing isomers also posed its challenge in the assessment of lindane. In the absence of a prescribed general policy on isomers, in the case of lindane (gamma-HCH) the Committee decided to evaluate the other two hexachlorocyclohexane isomers (alpha-HCH and beta-HCH) separately. After discussions at two subsequent meetings, the Committee recommended and the Conference of the Parties agreed on a general approach for considering isomers or groups of isomers. It was noted, however, that the approach had been developed to reflect the specific situation presented by lindane and might not be appropriate in the case of other chemicals. In brief, when considering a substance, the Committee could identify any important isomers with individual commercial uses and, where appropriate, urge any Party to consider proposing the isomer or isomers for listing.

• The next challenging issue was the review of commercial pentaBDE, for which no clear guidelines on commercial mixtures were available in the Convention text. Commercial pentabromodiphenyl ether (c-pentaBDE) contains congeners that include brominated products at the 3 (tri-) to the 9 (nano-) positions; the main component being the tetra- (4) and penta- (5) brominated products. The Committee eventually decided that it is necessary to clarify such a mixture in order to reveal the identity of all constituent chemicals.

• The issue of precursors arose when reviewing PFOS (perfluorooctane sulfonic acid). Since a nominated chemical may be a result of the transformation of another chemical
(the precursor) during the production stage or indeed of a naturally-occurring precursor, the Committee decided that such precursors must also be controlled. However, in the case of PFOS which has 96 known precursors, the POPRC recommended to the COP that only perfluorooctane sulfonyl fluoride (PFOSF), which is the parent compound of PFOS related substances, and perfluorooctane sulfonic acid and its salts, be listed as POPs.

- A teething challenge that was quickly apparent was the disparity in effectiveness of participation between POPRC members from the developed countries on the one hand and the developing countries on the other hand. Because of the breath-taking pace of the work of the Committee and the paucity of funds and other logistics to keep members in Geneva for longer than 6 days a year, a large chunk of the work had to be done on-line by individual members belonging to Intersessional Working Groups. This move was predicated on the erroneous assumptions of same levels of internet connectivity, electricity, and other related infrastructure in all member countries.

The challenges related to the science and technology divide and in particular the digital divide which hampered the effective contribution of committee members from developing countries, especially those from the Africa region, was articulated in a Conference Room Paper by this writer (the POPRC member representing Sierra Leone). This produced a warm and swift response from the Chairman and the Conference Secretariat and resources were mobilized for assistance to such vulnerable Committee members on the Chemicals Information Exchange Network (CIEN) Platform of UNEP Chemicals. Other vistas of intervention included regional capacity-building workshops aimed at improving effectiveness of participation in POPRC and other chemicals management meetings as well as on global monitoring activities. That the sixth Committee meeting and thereafter were successfully conducted as paperless meetings is a plausible testimony of the success of these interventions. An associated intervention was the commissioning and production of a Handbook for Effective Participation by the Intersessional Working Group chaired by the Committee member from Mexico, Mr. Mario Yarto.

The review of living chemicals (such as short-chain chlorinated paraffins and endosulfan) engendered a level of polemics that almost turned the decision-making stages of the plenary into battle fields, requiring several interventions of UNEP’s Legal Adviser for interpretations of the small and/or invisible prints of the Convention text. This occurred in addition to the unannounced cold war between the NGOs and the industry representatives within the observer cadre of the meetings. The frequent introduction of non-empirical modelling evidence to fill in the experimental data gaps on some of these living chemicals added to the suspicion that one axis of Committee members was wagging an economic war on another axis. Even those of us who simply wanted to improve the quality of the scientific discourse by using the same fine-tooth comb to go through the Risk Profile Evaluations as we do our theses became victims of this warfare by being wrongly classified and labelled along the corridors. The review processes were, however, able to progress thanks to the tenacity, resoluteness and diplomatic dexterity of the Chairman and his secretariat and with the help of a critical clause in the Convention text that states that the “lack of full scientific certainty shall not prevent the proposal from proceeding.”

The review process was further strengthened by the production (by members participating in Working Groups) of several Guidance Documents aimed at enabling and capacitating Parties to successfully implement the Convention mandate. The following Guidance Documents were produced:
• Guidance on considerations related to alternatives and substitutes for listed persistent organic pollutants and candidate chemicals, 2009 (UNEP/POPS/POPRC.5/10/Add.1);

• Guidance on alternatives to perfluorooctane sulfonic acid and its derivatives, 2011 (UNEP/POPS/POPRC.6/13/Add.3/Rev.1);

• Guidance on feasible flame-retardant alternatives to commercial pentabromodiphenyl ether, 2009 (UNEP/POPS/COP.4/INF24);

• Handbook for effective participation in the work of the POPs Review Committee under the Stockholm Convention, 2009\textsuperscript{13}. The associated Pocket Guide (2009)\textsuperscript{14} was produced and translated into the six UN languages and recommended for field work in connection with the development of National Implementation Plans for regulated chemicals.

This shows that over the past seven years since its first meeting, the POPRC has been a proactive assessment body that voluntarily took on additional mandates aimed at ensuring the wholesomeness of its operations.

One issue that remains hanging is that of persistence. Since persistence is a function of microbial activity that leads to the decomposition or otherwise of a given chemical, and given that microbial type and population are a function of moisture content, \textit{pH} and temperature, it is imperative that the criteria for persistence in the Convention text be governed by specified conditions of \textit{pH}, moisture content, and temperature. Such criteria could be defined by the POPRC members during the next meetings.
Works Cited


Notes