

Elimination of Persistent Organic Pollutants in Africa

by Richard Temsch

The Stockholm Convention (www.pops.int) is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms, and are toxic to humans and wildlife.

The Convention has classified nine pesticides as POPs (aldrin, chlordane, dichlorodiphenyltrichloroethane [DDT], dieldrin, endrin, heptachlor, hexachlorobenzene [HCB], mirex, and toxaphene), as well as polychlorobiphenyls (PCBs), polychlorinated dibenzodioxins (PCDDs) (dioxins), and polychlorinated dibenzofurans (PCDFs) (furans). Pesticides are produced intentionally and released intentionally into the environment. PCBs are produced intentionally, but are released unintentionally. Dioxins and furans, and sometimes also HCB and PCBs, are produced and released unintentionally; therefore, they are called UPOPs. The most significant application for PCBs is as a dielectric in transformers and other electrical equipment. Most countries stopped PCB production in the 1980s, but older equipment is still in use and stocks of waste are large. UPOPs are generated by many industrial processes, as well as by all types of combustion, including fuel burning in vehicles, waste incineration, and forest fires.

The Stockholm Convention is aimed at the reduction and, as much as possible, the elimination of POPs. It prohibits or restricts the production and use of POP pesticides and PCBs and limits their transportation to specific purposes, such as their safe disposal. Parties can claim certain exemptions, e.g., for the production and use of DDT to combat malaria. Since only the developed, industrialized countries possess adequate facilities for the safe destruction of POPs, the respective pesticides and PCBs, along with contaminated containers, equipment, and soil, have to be shipped from the developing countries to sites where such facilities exist. The most common and most universal method for disposal is high-temperature incineration. Other promising technologies that have been developed more recently include catalytic oxidation and plasma combustion.

The closest place to Africa with safe destruction capabilities is Europe. Many European high-temperature incinerators are not fully exploited and can accept POPs-contaminated waste from developing countries. However, disposal is expensive: With transportation, the costs amount to \$4000–5000 per ton. The magnitude of the problem is impressive: Africa has more than 100,000 tons of obsolete pesticides, and yet to be determined amounts of PCBs and PCB-contaminated waste. The developing countries cannot afford to pay such a high amount in full. Therefore, the Stockholm Convention stipulates that the industrialized countries will pay as donors for the incremental disposal costs. The Global Environmental Facility (GEF, www.gefweb.org) has been entrusted on an interim basis with the operations of the funding mechanism defined in Article 13 of the Convention, which suggests options, criteria, and modalities for funding. Only countries that have ratified the Convention are eligible for funding.

The Stockholm Convention was signed on May 23, 2001, by 93 parties (countries and regional economic integration organizations, such as the European Union). As of May 6, 2004, 165 parties had signed and/or ratified. The United States, the Russian Federation, China, and India have signed but have not yet ratified. Canada, Mexico, Germany, and Japan have already ratified. On February 17, 2004, France ratified the Convention as the 50th country. The Stockholm Convention entered into force 90 days after this 50th ratification and therefore became binding on May 17, 2004.

Most African countries have signed the Convention. Exceptions include Angola, the Democratic Republic of Congo, Equatorial Guinea, Eritrea, Libya, Namibia, Somalia, Swaziland, Uganda, and Western Sahara. Benin, Botswana, Chad, Côte d'Ivoire, Djibouti, Egypt, Ethiopia, Ghana, Lesotho, Liberia, Mali, Rwanda, Senegal, Sierra Leone, South Africa, and Tanzania had ratified the Convention by May 6, 2004.

The implementation of the Convention has already started. It goes through several phases. Each party country is expected to nominate a focal-point agency, which serves as a clearinghouse, to establish a National Project Steering Committee with representatives of the key stakeholders and to draft a National Implementation Plan. The first step is usually an inception workshop, explaining the Stockholm Convention and its objectives to the stakeholders in the country. This is followed by a training workshop for establishing POPs inventories. The participants of the training workshop are the designated inventory teams and other persons concerned with the task.

Over the last year, I have conducted training workshops on behalf of the United Nations Industrial Development Organization (UNIDO, www.unido.org) in Algeria, Djibouti, Ethiopia, Niger, Republic of Congo, and São Tomé and Príncipe. I have also carried out midterm evaluations of the inventory process in Algeria, Niger, and Togo. It was extremely interesting to work in these countries, which are all very different from one another. The national teams I have trained were all very motivated.

Algeria, Djibouti, Niger, Republic of Congo, and Togo were French colonies. Therefore, French is the common language, although various other languages are spoken by different parts of the populations. At one time, Togo was also a German colony. In Ethiopia, English is spoken well by most educated people, and in São Tomé and Príncipe Portuguese is the only native language. Thus far, the first foreign language there is French, but many students recently chose English instead.

São Tomé and Príncipe is Africa's smallest country—it is five times the size of Washington, D.C., and has only 175,000 inhabitants. It consists of several islands in the Gulf of Guinea. It is easy to find on a globe: Both latitude and longitude are close to zero. Since the country does not have a full-fledged university, all scientists and technicians have studied abroad—some in Portugal, Brazil, or Angola, where their mother tongue is spoken, and others in Cuba or Russia. Surprisingly, about two-thirds of the workshop attendees spoke Russian better than French.

Algeria, in contrast, is Africa's second largest country after Sudan. It is about 3.5 times the size of Texas, with a population comparable to California. It is very industrialized, with an emphasis on gas and petroleum extraction. Algeria is the world's second largest exporter of natural gas and is much wealthier than most of Africa.

Ethiopia is among Africa's poorest countries. It is landlocked and almost twice the size of Texas, and with 67 million people, almost twice as populous as California. About half of the population lives below the poverty line. Agriculture accounts for 50% of the GDP and 80% of employment. Ethiopia has never been a colony (during World War II it was occupied by Italy for a few years) and is one of the world's oldest independent countries.

Ethiopia's neighbor, Djibouti, is the only French-speaking country on the East African mainland. It is slightly smaller than Massachusetts and has

only 460,000 inhabitants, two-thirds of whom live in the capital. The rest are mainly nomads. The unemployment rate is over 50%. More than 80% of those employed work in the service industry. Agriculture accounts for only 3.5% of the GDP and industry for 16%. The port of Djibouti is the single largest economic activity in the country. It is linked with Addis Ababa by Ethiopia's and Djibouti's only railroad line and is a gateway for shipments to and from Ethiopia, including international food aid. Djibouti has become a major base for the fight against terrorism because of its strategic location in the Gulf of Aden. U.S. Marines, French Legionaries, and German Navy are numerous and have driven up hotel and restaurant prices to about double the African average.

The diversity of these countries is also reflected in their challenges to eliminate POPs. Obviously, the more agricultural countries, but also those with a severer malaria problem, have the largest stocks of pesticides. In Niger, for example, waves of grasshopper and locust invasions necessitate the use of acaricides. Termites pose a threat to agriculture and to building structures.

The more industrialized countries, such as Algeria, have the largest stock in PCBs. UPOPs have many sources, which are usually classified into 10 categories: waste incineration, ferrous and nonferrous metal production, power generation and heating, production of mineral products, transportation, uncontrolled combustion processes, production of chemicals and consumer goods, miscellaneous (drying of biomass, crematoria, smoke houses, dry cleaning residues, tobacco smoking), disposal and land filling, and "hot spots." The United Nations Environment Program (UNEP, www.unep.org) has developed a toolkit (a software tool based on Microsoft® Excel™ [Microsoft Corp., Redmond, WA]) that helps calculate the toxic equivalent quantities (TEQs) of UPOPs in these 10 categories. The TEQ values are used in order to compile a multitude of dioxins, furans, and nonintentional PCBs of very different toxicities in a single inventory spreadsheet.

The significance of the 10 categories varies depending on the country. Many African countries do not have municipal waste incinerators and burn waste in open air. In this case, the emissions fall into the "uncontrolled combustion processes" category. This category also includes brushfires, which are common in sub-Saharan Africa and occur both naturally and intentionally (for agricultural land use). Another important component in this category is the burning of firewood, the most common cooking method in many countries. The annual per capita consumption is in the range of one cubic meter.

Power generation is a major source for UPOPs, but only where it is based on fuel burning. Algeria generates more than 99% of its electrical power in thermoelectric plants, while Ethiopia has about 98% hydroelectric energy. Algeria produces 23 billion kWh, while Ethiopia, with twice the population, generates only 1.7 billion kWh per year. For comparison, the U.S. produces 71% thermopower, 21% nuclear power, 5.6% hydropower, and 2.3% from alternative sources. The annual per capita consumption in the U.S. is 12,500 kWh—about 500 times higher than in Ethiopia and three times higher than in South Africa, by far the continent's most industrialized country.

Motor vehicles are becoming a greater source of dioxin and furan generation, in particular in those countries in which the standard of living is on the rise. While automobiles are not as numerous as in the developed countries, the emissions per vehicle are much higher because of leaded gasoline, old age, and bad engine tuning. Unleaded gasoline is only available in a few African countries, but in Algeria, for example, many cars run on liquefied petroleum gas (LPG).

Contaminated sites are an important part of POPs inventories. They have to be identified, quantified, and earmarked for remediation. In some cases, contaminated soil will have to be treated abroad.

To complement the inventory exercises, a study of the impact of POPs on health and environment in the country has to be conducted, and a National Profile of Chemical Substances Management must be established or updated. The Stockholm Convention also demands that public awareness be raised and that education and training with regard to POPs be promoted.

Most of the guidelines for POPs inventorying, i.e., sample collection and analysis, which I use in the training courses, are derived from U.S. EPA recommendations. Other sources of information are environmental authorities, research institutes, and private companies in different parts of the world, such as the European Union, Australia, Canada, Japan, and Thailand, as well as UN agencies (e.g., UNEP, UNIDO, WHO, and WMO). The francophone countries in Africa like, in particular, Canadian Web sites; they are usually both in English and French.

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