

## **INTRODUCTION**

Cameroon like most developing countries is facing severe environmental and public health problems with obsolete pesticide stocks. Pesticides were given, purchased or received with very good intentions. Unfortunately the very pesticides that were meant to bring good, increase food, prevent or destroy pests, have, on the contrary, turned against the health of human beings, animals and the environment.

Cameroon is situated along the coast of West Africa, and has a population of 13 million inhabitants, and depends on agriculture and oil industry for the formation of its gross domestic product. It is also one of the five countries whose coast forms part of the Gulf of Guinea Large Marine Ecosystem (LME). Its coastal line stretches for 1,500 km, while its territorial waters extend over 35,000 km<sup>2</sup>. The marine coast is rich with a variety of fish and plant life such as mangroves which however are exposed to land and air pollution generated by agriculture and industry.

It is estimated that 40,000 metric tons of fish are caught annually (from inland and coastal waters) of which about one third is exported. This activity accounts for about 50,000 jobs, of which 34,000 are artisanal. The maximum sustainable yield (MSY) of fish is about 35,000 tons/yr. In 1994, the export of fish to Europe was worth US\$ 60 million, with 74% of catch accountable to the activities of 12 industrial scale fishing companies. Furthermore, mangroves, the natural habitat of a variety of marine fauna, covers a total surface area of 1,000 km<sup>2</sup>, of which 35 different species have been identified, with the main species being the *Rhizophora* spp.

About 95% of Cameroon's industry lie along the coastal town of Douala (the economic capital and most populous town in Cameroon) and reject all of their liquid wastes into urban drainage network which in turn is emptied into the Atlantic Ocean, without prior treatment. Out of these industries, less than 10% operate and own waste water treatment facilities, and they do so under different standards.

The aim of this paper is to present the Constraints Cameroon is facing in the management of Persistent Organic Pesticides(POPs) which find their way into the marine environment and contributes to the destruction of the said environment. An attempt will be made to outline some of the courses and sources of POPs, their effects on the marine environment, human health and socio-economic society as well as responses, policies and mechanisms that the government has done or still to do in order to arrest the situation within the context of international legislation. The marine ecosystem of Wouri estuary in Douala, the country's main port and industrial town, a confluence of three rivers that drain into the Atlantic Ocean will be the centre for discussion.

## PESTICIDES IN CAMEROON

The agricultural sector contributes almost 50% to all activities. The food crop sub-sector is responsible for the greater part of the public investment budget. Despite the production of oil in the country, Cameroon's economy stands based on agriculture. In this regard the use of pesticides is considered indispensable in agricultural production giving the same importance as fertilizers and improved seed varieties. The reason for this is that plant diseases can reduce or wipe out many crop productions in the country. While waiting for on-going research to come with new farming methods and resistant varieties, the use of pesticides or chemicals(insecticides, fungicides, and herbicides) are for the time being, the only means through which crop production and future harvests can be guaranteed.

## MARINE RESOURCES

The coast of Cameroon which is also part of the Gulf of Guinea is rich with marine life and well endowed with fisheries (deep sea and coastal). It is estimated that some 1 million metric tons of fish are caught annually of which about one third is exported. In addition, invaluable species of other animal and wild life are known to exist in the coastal line. Extensive mangroves, primarily *Rhizophora* spp. Occur along the coast and constitute critical habitat for many crustaceans, mollusc, fish and birds. Even though mangroves provide critical spawning grounds for numerous species of fish, including

many important commercial species, Cameroon has few conservation reserves to protect its mangroves, and these can rapidly disappear, which makes mangrove preservation an important global consideration.

In 1989, due to the financial crisis that hit the country, the government decided to liberalize and privatise the use of pesticides. This led to an increased acquisition and use of pesticides. As a result of these, stock piles of pesticides in deteriorating leaking containers in some parts of the country were used by farmers. Some of these chemicals were stored in the open and were causing considerable environmental pollution and risk to health.

Some of the pesticides in this condition were:

Pesticides	Active ingredient (ai)	Quantities (litres)
Sumithion	Fenitrothion	92510
Extrofoal H N 12	M ipc	92400
Gammophele 320	Lindane	20185
Dursban 240 ulv	ChlorpyriFos Ethyl	18120
Callindim Fc 320	Lindane	15420
Sumicombi 183 ulv	Fenitrothion + Fenvalerate	14300
Diazinom	Diazinom	12100
Aldrin	Aldrin	495 (kg)
Deldrin	Deldrin	9750
Orthodifolatan	Orthodifolatan	92250 (kg)

The last three products (Aldrin, Dieldrin and Orthodifolatan were banned chemicals in the country in 1989 (Souop 2000)

A more recent study (Assessment of Climate Change Impacts on the Cameroon Estuary Mangrove) was carried out in the ecosystem of the estuary mangroves of Cameroon located in the middle of the Gulf of Guinea. It showed that a significant pollution of

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pesticides classified as Persistent Organic Pollutants (POPs) were present (Sama and Gimou). This pollution originates from towns that are heavily populated and industrialized and from agricultural fields (mechanised agriculture), petroleum refineries, and its marine products as shown in the table below:

Concentrations (mg/kg)

	Lindane	Aldrin	DDT	PCB	-
Fish	1.6	2.4	-	-	MBI & MBOME
Shrimp	0.98	ND	244	342	MBOME & MB 119
Oysters	1.44	1.71	113	209	-

ND: Not detected

Source: From Assessment of Climate Change Impacts on the Cameroon Estuary Mangrove Ecosystem 1991.

## MAIN SOURCES OF MARINE POLLUTION

Despite the existence of stockpiles of POPs, the rapid growth or increase in the volume and diversity of industrial wastes which are being discharged without treatment into the rivers and the sea, are threatening the marine environment and human health. The main sources of POPs are industry, agriculture, and to a lesser extent, municipal wastes.

It is estimated that over 60% of the existing industries are concentrated on the coastal cities and towns of Cameroon. Apart from manufacturing industries, solid mineral mining and oil drilling as well as petroleum refinery are major causes for surface and underground water pollution and ecological degradation.

Due to fast urbanization, municipal sewage with high organic loads (in some cases BOD of 22,400 mg/kg) and in most cases without sufficient treatment is discharged into the

sea. In most cities, population access rate to sewage system and ownership of septic tanks are at 30% and 45% respectively.

Export of agricultural produce such as coffee, cocoa, bananas, palm oil, cotton etc., are on the rise and more land is cultivated for this purpose. The production of these crops implies the application of imported pesticides and fertilizers. For example, in Cameroon, the main types of fertilizers applied contain urea, ammonia, and phosphorus. Most pesticides applied are DDT and other derivatives of organohalogens such as Aldrin and Dieldrin, toxaphene.

Oil spills and occasional catastrophic oil blow out have released thousands of barrels of oil into the sea though the exact total discharge is unknown. The quantities spilled so far have created problems ranging from the contamination of beaches and physical infrastructure of the port of Douala, destruction of sea birds, to the killing and contamination of marine life resources such as mangroves.

#### IMPACT ON THE MARINE ENVIRONMENT, HUMAN HEALTH AND SOCIO-ECONOMIC OF THE COUNTRY

POPs are also known to bio-accumulate in food chains, and cancerous, also have negative impact on human health. Few studies have been undertaken on the impacts on human health. However, as concerns marine environment; the major conclusions from International Union for the Conservation of Nature (IUCN) study on mangroves in Cameroon in 1991, show;

- (i) decrease in fish population (about 15% per year) either due to migration, deaths or over harvesting,
- (ii) 2.6% annual decrease in the surface area covered by mangroves, particularly in zones near to oil refineries and oil drilling activities,
- (iii) high content of Tri-butyl Tin (TBT) is an anti-algae paint use in ship yards in the flesh of molluscs and reduction in the harvest of crustacean.

The per capita consumption of fish in Cameroon is 18 kg/ year, of which 39% depend on coastal harvested marine fish. Fish contributes to 44% of protein intake in the general population. The increase in concentration of POPs in fish is therefore

dangerous to human health. Secondly, the economic loss is enormous about 4,500 tons per year, which is valued at about US\$ 5.85 million at local prices today.

The marine environment and human health are exposed to unsustainable practice of industrial and agricultural production in the country, and in face of increasing population the danger will become visibly potential in the next few years, if no measures are taken now.

#### LEVEL OF IMPLEMENTATION

Institutionally, pollution control is dispersed among many government departments, with little coordination. “Command and-control”, in which enforcement is weak, and expensive, is widely applied. There is no national legislation which covers all the aspects of environmental protection as well as sensitization. On the other hand, it is signatory to many international conventions such as the MARPOL, the FAO on pesticides, Bamako convention on the prevention of importation of hazardous wastes, etc.; and is still party to the negotiation of other conventions and guidelines. However, it hasn’t adequate financial and managerial capacity to enforce the conventions.

Historically, pollution control is an activity that is legislated upon and controlled by Government. However, local enforcement is weak due to lack of financial resources, equipment, and personnel.

The institutional frameworks on environmental protection in general are still in their embryonic stage. It is noted that the municipality of government departments involved in pollution control matters, make use of the “Command and Control” approach. Compared to economic incentives, this approach is ineffective and expensive to enforce. Because polluters can pay for pollution charges (calculated out of the basis of opportunity cost of foregone or destroyed resource), the incentives to prevent pollution is absent. Pollution monitoring is a recent event in Cameroon, and even where it is undertaken, the foreign or international standards are not applied. Cameroon does not operate the minimum pollution control measures nor own abatement infrastructure, and in cases where they exist, they operate out of

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universally acceptable standards. High pollution loads of heavy metals such as mercury, lead, cadmium have been registered in some areas, due to continuous disposition over the past years.

In Cameroon the Ministry of Environment and Forestry (MINEF) is at the centre of implementation, coordination and evaluation of the institutional and legal frameworks. Within this framework, management of dangerous and toxic chemicals that pose risk to human health and the environment have been addressed. Despite this, the national capacity for implementation of the aforementioned instruments is still weak; in particular one notes the absence of comprehensive legislation and capacity for enforcement, low level of public awareness, weak technical infrastructure as well as lack of reliable database. The approach used to monitor the disposal of pollutants in general is based on ‘‘command and control’’ which is known to be ineffective and expensive as well as being media- specific.

Despite the fact that the government has a list of registered products with their respective uses, this information is not exposed to the public and this is in contravention with Article 10 of the Stockholm Convention 2001 on POPs related to Public information, awareness and education which states that:

Each Party shall, within its capabilities, promote and facilitate:

(a) Awareness among its policy and decision makers with regard to persistent organic pollutants;

Article 3 on Pest Management paragraph 3.1 in FAO 2002 states that: Governments have the overall responsibility to regulate the availability, distribution and uses of pesticides in their countries and should ensure the allocation of adequate resources for this mandate

## OBSOLETE PESTICIDE STOCKS

### ORIGIN

Pesticides were considered the miracle weapons for the prevention and control of pests and for boosting agricultural production. The early discoveries of organochlorine pesticides received high acclamation, recognition and rewards. However, the euphoria was not to last for ever. During the 1960s, some of the revealing accounts of the negative environmental impact of the pesticides concerned became apparent. By the 1970s some of the persistent organochlorine were banned from use in almost all developed countries. Most are persistent in the environment, are hazardous, contaminants and pollutants. In good faith, donors and organizations assisted developing countries by donating pesticides to countries in the tropics, particularly in sub-Saharan Africa where pests are most prevalent, endemic, persistent and widespread. Cameroon was included and was happy and satisfied to get the assistance. She also purchased or requested pesticides in abundance, not because of greed but because of the need to protect crops against the outbreak of devastating seasonal and endemic pests. Unfortunately, some of the vary pesticides intended for a good purpose that were received or given with good intensions, or purchased in good faith, accumulated over the years. These left-over, obsolete pesticides are now giving rise to serious environmental and health problems.

### REASONS FOR THE STOCKPILES OF CEMICALS

Several reasons are responsible for piles of obsolete pesticides in Cameroon. Some important contributing factors are:

- Banned pesticides were still kept in the stores.
- Over stocking resulting from poor assessment of requirements or difficulties in forecasting outbreaks of pests.
- In appropriate formulations or poor quality containers, substandard stores and poor stock arrangement.
- Aggressive sales promotion by the pesticide industry

- A significant part of the stocks are left over of pesticides obtained under aid agreements. Excessive donations that arrived too late as well as gifts of inappropriate products have all made important contributions to the problem.
- Lack of labor: until 1998, the staff who applied pesticides was paid by the agricultural bank FONADER. This institution went in to liquidation and their agents dismissed. As an emergency measure, the EEC which supported the purchase of pesticides for the 1989-1990 seasons had provided funds for part time employment of a limited number of field workers. This program ended in 1992.
- Lack of planned purchasing and distribution policy: in several instances, too many chemicals were bought and then distributed to stations which had not yet finished their previous year's supply. This had led to an increase in the stock piles of pesticides at some stations.
- Lack of protective clothing and first aid equipments: in some stations, there were no protective clothing, gloves, rubber boots and face masks. This resulted in the chemicals not being used. This is against Article 16 paragraph 3 of the Convention concerning Occupational safety and Health Convention 1983 and the working environment which states that: Employers shall be required to provide, where necessary, adequate protective clothing and protective equipment to prevent, so far as reasonably practicable, risk of accidents or of adverse effects on health.
- Lack of transport: most stations had no vehicles in working condition. This made it difficult to distribute pesticides and to send agents to the farmers' fields.
- Lack of spraying equipments.
- Lack of regulation or implementation measures.

## THREATS POSED BY OBSOLETE PESTICIDES

Vast amounts of unused pesticides threaten the environment and public health in Cameroon. Without a concerted national effort and ongoing commitment, the damage to the environment will be irreversible and the effect on human health may reach catastrophic levels.

Leakage, seepage and accidents are both common and widespread. The stocks invariably pose a severe threat to human health and the environment, particularly when – as most are urban areas or near water/oceans. Ground water, irrigation water and drinking water are at risk, and humans, livestock and food are in danger of direct exposure. Disasters can be expected if adequate action is not taken.

The stocks are gradually increasing because of the lack of environmentally sound disposal facilities in the country. Drums are even stored in the open, exposed to direct sunlight and rain and, as time go by, they deteriorate and start leaking.

Cameroon is a developing country and as such does not have the disposal facilities, know-how, or financial resources to tackle this alarming problem. Disposal is neither cheap nor simple.

## PROBLEMS ASSOCIATED WITH THE USE OF OBSOLETE PESTICIDES

The problem of obsolete pesticides remains extremely serious and urgent. Many of the stocks identified continue to deteriorate thereby giving rise to an ever escalating source of severe pollution and posing a threat to human health, the environment and development in particular. The situation is most serious in most developing countries including Cameroon because there is little awareness of the inherent danger of pesticides. There have neither the capacity nor the facilities for disposal, nor the financial resources to handle problems to obsolete pesticides.

## MAIN CONCERN

The concern is not only about obsolete pesticide stocks, which have given rise to serious environmental problems, but also the fear of their possible accumulation in future. Disposal of existing stocks is as important as prevention of accumulation. The latter reflects the lack of attention paid to various important aspects such as management of pesticides and their use and distribution.

Generally, the use of pesticides in Cameroon is done with little or no consideration to the environment and to the workers handling the chemicals. Workers and farmers are regularly exposed to these pesticides and therefore experience serious problems with their health. The greatest risks are the workers involved in mixing and loading of these pesticides. In most cases, there are no protective clothing and nose masks to prevent inhaling the gas fumes.

Pesticide use in Cameroon indicates that it is difficult to follow label instructions and recommendations as stated. These conditions include: high temperatures and humidity, lack of protective clothing, leaking knapsack sprayers, illiteracy, lack of facilities for washing, or medical treatment and repeated exposure.

With a long list of pesticides being used in Cameroon, there might be no scientific evidence that there are toxic and may cause health or hazards to man or the environment. Thus it is as important to at least apply the Precautionary Principle as indicated in Agenda 21 of the Rio Summit 1992, and the Treaty on Persistent Organic Pollutants in 2001 also known as the Stockholm Convention. Preventive measures to protect health and the environment should be undertaken even when risks are not fully understood, or where there are gaps in knowledge either on the precise effects of the pesticides or on the mechanism of toxicity.

The degradation of the marine environment resulting from land-based activities like the use of pesticides is very important. The Global Programme of action (GPA) embarked on a Programme to prevent degradation of the marine environment arising from land-based activities. It was geared towards helping states to undertake measures (individually or collectively and taking into account their policies, priorities and respective resources), aimed at preventing, reducing, controlling and/or eliminating the degradation of the marine environment or to remedy the effects of land-based activities. The Global Programme of action defined POPs as organic compounds that:

Possess toxic characteristics, persistent and liable to bioaccumulations; prone to long-range transport and deposition far from their source, and can therefore result in adverse environmental and human health effects at locations near and far from their source. They have low water solubility and high fat solubility.

The Stockholm Convention on Persistent Organic Pollutants (POPs) has widely stated some Articles in order to check the manufacture, importation, use and elimination of these chemicals. Article 3 deals with measures to reduce or eliminate releases from international production and use. It states that each Party shall:

- (a) Prohibit and/or take the legal and administrative measures necessary to eliminate
    - (i) Its production and use of chemicals listed in Annex subject to the provisions of that Annex A; and
    - (ii) Its import and export of the chemicals listed in Annex A in accordance with the provisions of paragraph 2; and
  - (b) Restrict its production and use of chemicals listed in Annex B in accordance with the provisions of that Annex.
- (2) Each Party shall take measures to ensure:
- (a) That a chemical listed in Annex A or Annex B is imported only:
    - (i) For the purpose of environmentally sound disposal as set forth in paragraph 1 (d) of Article 6; or
    - (ii) For a use or purpose which is permitted for that Party under Annex A or Annex B.

Article 6 of the same convention deals with measures to reduce or eliminate releases from stockpiles and wastes.

1. In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with chemical listed in Annex A, B, or C are managed in a manner protective of human health and the environment, each Party shall:
  - (a) Develop appropriate strategies for identifying:
    - (i) Stockpiles consisting of or containing chemicals listed either in Annex A or Annex B; and
    - (ii) Products and articles in use and wastes consisting of containing or contaminated with a chemical listed in Annex A, B, or C;
  - (b) Identify, to the extent practicable, stockpiles consisting of or containing chemicals listed in Annex A or Annex B on the basis of the strategies referred to in subparagraph (a).
  - (c) Manage stockpiles, as appropriate, in a safe, efficient and environmentally sound manner. Stockpiles of chemicals listed in Annex A or Annex B, after they are no longer allowed to be used according to any specific exemption specified in Annex A or any specific exemption or acceptable purpose specified in Annex B, except stockpiles which are allowed to be exported according to paragraph 2 or Article 3, shall be deemed to be waste and shall be managed in accordance with paragraph (d);
  - (d) Take appropriate measures so that such wastes, including products and articles upon becoming wastes are:
    - (i) Handled, collected, transported and stored in an environmentally sound manner;
    - (ii) Disposed of in such a way that the persistent organic pollutant content is destroyed or irreversibly transformed so that they do not exhibit the characteristics of persistent organic pollutants or otherwise disposed of in an environmentally sound manner when destruction or irreversible transformation does not represent the environmentally preferable option or the

persistent organic pollutant content is low, taking into account international rules, standards, and guidelines, including those that may be developed pursuant to paragraph 2, any relevant global and regional regimes governing the management of hazardous wastes;

- (iii) Not permitted to be subjected to disposal operations that may lead to recovery, recycling, reclamation, direct reuse or alternative uses of persistent organic pollutants.

Article 10 of this same Convention deals with public information, awareness, and education. It states that:

- (1) Each Party shall, within its capabilities, promote and facilitate;
  - (a) Awareness among its policy decision makers with regard to persistent organic pollutants;
  - (b) Provision to the public of all available information on persistent organic pollutants, taking into account paragraph 5 of Article 9;
  - (c) Development and implementation, especially for women, children and least educated and public awareness programs on persistent organic pollutants, as well as on their health and environmental effects and on their alternatives.

Article 11 elaborates on research, development and monitoring as outlined thus:

- (1) The parties shall, within their capabilities, at the national and international levels, encourage and/or undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants and, where relevant, to their alternative and to candidate persistent organic pollutants, including on their:
  - (a) Sources and releases into the environment;
  - (b) Presence, levels and trends in humans and the environment;
  - (c) Environmental transport, fate and transformation;
  - (d) Effects on human health and environment;
  - (e) Socio-economic and cultural impacts;
  - (f) Release reduction/ or elimination; and

- (g) Harmonized methodologies for making inventories of generating sources and analytical techniques for measurement of releases.

## SUGGESTED STRATEGIES

The following strategies could be put in place in order to tackle some of these pollution problems. They are:

- **The identification and prevention of pollution at the source:** an inventory of all industrial and agricultural sites that are recyclable, and pollution loads should be carried out with the view to identify areas of pollution prevention, and institution of pollution disincentives.
- **Strengthening the capacity of government:** to elaborate, enforce and monitor environmental legislation; to undertake training and applied research, increase the scope and depth of transfer of environmental technologies in the area of waste management, and the provision of alternative chemicals to those that are or degenerate into POPs.
- **Increase sensitization of all actors, by implicating NGOs:** irrational and wrong selection of pesticides are still used in fishing, agriculture, while the list of dangerous or banned chemicals which are POPs are still unknown to a wide cross section of the country. Environmental education and regulations on this issue can be accelerated by co-operation between Government, NGOs, industry and developed countries from where these are imported. NGOs should be given support to increase awareness among industry, farmers and fishermen.
- **Technological transfer should be accelerated from the “North to the South”** by removal of barriers such as intellectual proprietary rights, collaborative efforts in applied research programmes, particularly in information technologies and process design.
- **To embark immediately on “Banned” Pesticidal Disposal and Reduction Plan** in view of past circulars on banned pesticides and POPs, and the impending convention on the PIC procedure. There is urgent need for a global

plan to dispose of outstanding stocks of such pesticides as Dieldrin, which is still handled under poor conditions in the country. A national inventory at the level of the country is necessary, and the plan should be carried out in collaboration with local NGOs, industry and the Government.

#### SOME POLICIES THAT COULD BE ADOPTED

- Application of Prior Informed Consent (PIC) procedure: Most developing countries such as Cameroon need further support to strengthen the capacity of Government departments involved in the elaboration, implementation and monitoring of environmental regulations and policies. The strengthening power ranges from man power training in environmental management and law, equipment acquisition, setting up of national data banks and registers on dangerous chemicals, assistance in the setting up of proper regulations and enforcement agencies.
- Introduce market based incentives (MBI) in preference to “Command and Control-CAC”. Cameroon has experienced that the CAC approach is expensive and inefficient to administer. Therefore, it is only in a market based incentive environment that concepts such as ‘cleaner production’ technologies can operate e.g. in the paint industry where POPs such as phenols and other benzene-based chemicals are predominantly used, water-based paints using resins and locally produced caesins could be encouraged. Recycling of waste water to recover alcohol by column stripping (which has high recovery rate) should be disseminated
- International co-operation among nations on aspects such as exchange of information on the origins and pathways, disposal and risks of POPs should be reinforced by the UNEP and FAO. Large stocks of strictly traded or banned pesticides such as Dieldrin, Aldrin and DDT are still existing with no answers as yet to their disposal. In the near future the country should be involved in the process to develop alternatives to prohibit chemicals and also receive financing for the said operations within an acceptable timetable. The financial

mechanism of the Montreal convention and the Biodiversity convention, should serve as working models for discussions between Cameroon and the developed countries.

## CONCLUSION

The institutional framework of environmental protection in general, and pollution prevention in particular is still weak in Cameroon. The Government is still embarked on the traditional approach of 'command and control' when dealing with pollution matters. They are ineffective, and expensive to enforce, particularly in the absence of standards and equipment. Secondly, in a trend of globalization of the world economy, competition in tradable goods is getting more related to environmental quality, and sustainable development is now the major concern of nearly all domains of the world economy. Cameroon must therefore overcome challenges currently faced with depletion of marine resources, which constitute an important segment of trade and embrace measures to regenerate the resources and promote sustainable economic growth.

At national level, because the coastal marine of Cameroon forms a continuation of the Gulf of Guinea ( LME) that is also exposed to transboundary pollution from other countries in the area through ocean currents of the Atlantic Ocean that converge along the Cameroon's coastline concerted, action is needed to prevent pollution of the large marine ecosystem.