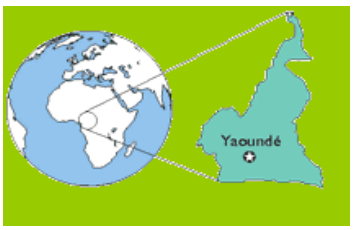
5. PART II- COUNTRY PRESENTATIONS AND REPORTS

CAMEROON



Regional workshop on Successful Case Studies on Hazardous waste management
Ibadan, 9-12th August 2004

Location of Cameroon in Africa

Between longitude 7° and 16° East, and latitude 2° and 14° North, surface area 475,422km^{2}roughly twice the size of Ghana,
Borders Nigeria, Chad, CAR, CR $ Equatorial Guinea
Rich in Biodiversity with Savannah, Rain Forest, Desert
Rainy $ Dry seasons
15M people: GDP $9.6 bn
French and English official languages,
250 ethnic groups with 135 local languages,
Currency: Francs CFA
English and French Law – no impact on the environmental law.
Administrative capital Yaoundé, Commercial Douala

Definitions of waste

- According to framework law No 96/12 0f 5th August 1996 relating to Environmental Management :

Waste is any residue from production, processing or utilization process, any substance or material produced or, more generally, any movable and immovable goods abandoned or intended to be abandoned

- According to Law no. 89/27 of 29th December 1989 relating to toxic and hazardous waste:

Any waste which is toxic, containing inflammable substances, explosives, and radioactives that can pose a danger to human health, animals, flora and fauna, and the environment.

Hazardous waste in Cameroon

- Waste oils, combustion gases, oil filters, treated poles, batteries, CFCs, PCBs, Asbestos, medical waste, and refinery sludge.
- Inventory of Hazardous Waste
- No inventory has been conducted on hazardous waste generation in Cameroon.
- Sources
- Industries, mechanic garages, service stations, hospitals, laboratories, pharmacies, dump areas, refinery etc.

Hazardous Waste Contaminated sites

- Dump areas
- Thermal power plants,
- Polluted rivers, streams and wells,
- Oil spill sites, and
- Refinery.

Institutional Stakeholders

- Ministry of Environment and Forest
- Ministry of Mines, Water resources and Energy
- Ministry of Public Health
- Ministry of Agriculture
- Ministry of Territorial Administration
- Licensed waste handlers
- Industry sector

Legislation and Regulations

❑ **National**

- The 1996 Constitution,
- Law no. 96/12 of 5th August 1996 relating to environmental management,
- Law no. 89/27 of 29th December 1989 relating to toxic and hazardous waste,
- Ministerial Order No. 039/MTPS/IMT of 26th November 1984 relating to hygiene and safety at the workplace

- **International**

- Basel Convention,
- Stockholm Convention,
- Bamako Convention, and
- Rotterdam Convention

Management Practices/Industry efforts in Hazardous waste management

- Interim storage,
- Reuse and recycling (Bocom, Mobil, etc.)
- Incineration – medical waste and sludge
- Phase out of PCB-transformers,
- Use of non-PCB oils,
- Landfill development (Alucam)

Public Awareness of Hazardous Waste issues

- Lack of awareness
- Poor attitude (poor handling practices)
- Lack of knowledge and technology in handling and disposal of hazardous waste among the various stakeholders,
- Lack of adequate legislation (fragmented and haphazard)
- There is lack of a comprehensive legislation which regulates hazardous waste handling,

- Inadequate data and information
- There is lack of data and information on the generation and management practices,

National needs

- Awareness and formal training,
- Adequate legislation and regulation,
- Modern technology/infrastructure
- Adequate and efficient treatment facilities.
- Economic incentives are needed - best achieved by tax exoneration,
- Technical and financial support.

Way Forward

- Obtain Financing,
- Raise Awareness traversally,
- Conduct Inventory,
- Management,
- Reporting,
- Review.

HAZARDOUS WASTE MANAGEMENT REPORT OF DEMOCRATIC REPUBLIC OF CONGO

BY

- **Mr. LUNGILI KABUKA Damien**
- **Mr. EMENE ELENGA Jean Claude**
- **Prof. OKOND'AHOKA José**

1. EXECUTIVE SUMMARY

Situated in the heart of Africa, the Democratic Republic of Congo covers an area of 2,345,000 Km². The average Congolese population has been estimated at 43,852,501 habitants in 1995. With annual growth rates of 3,3%, the country could count 53,826,927 habitants in year 2001

(Programme National de Relance de secteur agricole et rural 1997-2001, vol. III.). It presents the following characteristics: average density: 19 habitants /Km², urban population 30%, rural population 70%.

The problem of the presence of hazardous wastes in DRC puts itself with acuity due to the multiple contraints : lack of organisation of public services of the state, absence of statutory and legislative texts, absence of equipped laboratories, lack of financial and technical means …They contribute to the deterioration of the quality of life in abiotic and biotic compartments of the country. New hazardous wastes more and more noumerous are liveliness to take emphasis in DRC.

2. Hazardous wastes mainstreams with priotisation :

2.1. Sources characterization

2.1.1. Biomedical wastes: Democratic Republic of Congo has 500 hospital centers (public and private) . In a recent survey in Kinshasa, for a hospital of 300 beds and a strength of nursing staff of about 200, and for a period of about one month, the quantity of the bio-medical wastes was 1,180 Kg.

This situation poses some serious problems for the hospitals of the country concerning solid wastes management. However, the liquid wastes have not been of concern in this survey.Currently, the Ministry of the Environment of the Brussels-capital Region in collaborating with the Ministry of the Environment of the DRC drives a survey on the bio-medical wastes management in the city of Kinshasa, the Capital. In the same way, the NGO called"Action for the rational management of the chemicals and the hazardous wastes " intend to carry out survey of states places of bio-medical wastes on all the extent of the national territory.

2.1.2.Industrial wastes: : industries in DRC are varied and among them we mention:

- mining industries:actual industries producing the solid wastes and liquids etc. on basis of heavy metals (Pb, Zn, Hg, Cu, As, Co, Cd)

-textile industries: the DRC possesses six textile industries distributed between city of Kinshasa(CPA,UTEXAFRICA), the city of Kisangani(SYNTEXKI and SOTEXKI), the city of

Kalemie(FILTISAF), the city of Lubumbashi .It already agrees to signal that sewages of these industries are poured in courses of waters notably in the stream Congo.

-industries of manufacture and repair of batteries for auto: the management of this real problem of wastes pose since they are scattered through the country in the wild discharges.

-Oil industries: two oil societies of prospecting and producting (CHEVRON-TEXACO and PERENCO-REP) and one of raffinage(SOCIR).The organized wastes of muds of forage and bottom of tanks are poured at the level of the coast of the stream Congo and the coastline of the Antlantic ocean.

-industries of paintings and ink: various wastes coming from these industries are scattered in wild discharges.

-Chemical and pharmaceutical industries: notably manufacture of sulphuric acid and medicines etc.

-industries of plastic matters(like PVC)

-the nuclear power station of Kinshasa and the mine of SHIKOILOBWE in the Katanga: notably the production of wastes coming from marking and radioimmunoessay puts a real problem of management of its wastes in Kinshasa and at the mine of SHIKOLOBWE, the illicit exploitation, by the population, of the cobalt containing a certain percentage of uranium is of concern the Congolese government in particular and the international community in general.

-power station(societies of electricity): the RDC possesses the biggest hydroelectric power station in Africa.The working of these various power stations requires the utilization of several thousand of transformers, capacitors and other materials containing ois PCBs.Currently, an inventory is liveliness to be driven by the Ministry of the Environment with the support of the SADC/UNEP.

-plastic matter industries: producing new types of wastes no bio-degradable putting a real problem as for their elimination.

2.1.3. Importation: in this sector, the DRC imports manufactured products for its needs but, receives also as grands from friend foreign countries.The surplus or the no utilization of the so-called products due often to the expired stocks.It is the case of the 360 tons of the obsolete pesticides stocked in warehouses of Congo container in Kinshasa. This situation is general for the whole of the country.Other chemicals considered like intrants are imported by the DRC.

Cases of the unverified allegations of the fraudulent imports of the hazardous wastes in DRC are not to be excluded. Indeed, the DRC shares its long border of 6,500 Km with 9 neighboring countries and let a certain permeabilty to the traffic of all kind.

2.1.4.Export: in spite of the presence of certain obsolete stocks signalled above , the DRC doesn't export the hazardous wastes toward the outside.

2.2.Quantities/generation in tons per annum

Because of lack of coordination of services of the state implied on the subject in the hazardous wastes management and the absence of statutory and legislative texts , the statistics on hazardous wastes in DRC are not known.

2.3. Current Management Pratices including Waste Minimisation and Recycling.

The absence of the politic of hazardous wastes management drives to practices no ecologically rational: it is the case of landfill, incineration and uncontrolled discharges in rivers and public places.

2.4. Treatment /Disposal Methods

The methods of treatment/disposal concern the practices enumerated in 2.3.

3. Highlight technologies e.g landfill, incineration, thermal desorption

Actually, the DRC doesn't arrange a no state-of-the-art technology for the elimination/disposal of this hazardous wastes category.

4. Indicate known Environmental and Health Impacts.

- Survey of human contamination by organochlirine pesticides in Zaïre(DRC), by Okond'Ahoka and coll. in Ann.Fals.Exp.Chim.-Novembre 1984-77-N°832-pp.531-540
- Survey of human contamination by lead in vegetable(anonyme)
- Piscatorial species reduction by pesticides and the industrial wastes.
- Contamination of fishes and other biotic species aquatic downstream points of industrial sewage tipping for example at the level of Chanimétal at Kintambo and the Kapolowe river at Likasi.Cases of the pollution of the Garumba river by dismissals of cyanides and mercury used in research and the production of gold drove to the death of fish species and other house pets. One also deplored case of poisoning with death of man to the same site.
- At Katanga, moon of provinces of the DRC, one notes the metallurgic acidic rain factories resulting in the oxidization of sheet metal and the impoverishment of soils.
- At the level of the mouth of the stream Congo and the coastline of the Atlantic ocean, it notes the pollution of park mangroves and ecosystems by local oil industry dismissals.
- To the site of the company oil PERENCO-REP exploiting in on shore, one notes the fluorose of the surrounding vegetation.
- Accumulation of muds polluted in rivers and stream notably the Katapula river at the Katanga and the stream Congo,

5.Catalogue Hazwaste Contaminated sites and any remediation activities.

The some sites listed to the point 4 endure absence of remediation activities for lack of the technical and financial means as well as of the statutory and legislative texts on the subject.

6.National Institutional and Regulatory Framework for Hazwastes.

The Ministry of the 'Environment put on foot a loaded interdepartmental commission of the destruction of the hazardous wastes and the rotting products, but, this structure is not operational for lack of coordination of services implied and of capacity backing.The new promulgated mining code foresees a relative disposition to the hazardous wastes regulation in DRC.

7. List of Existing Laws and Regulations

Besides the code and the mining regulation already promulgated, the DRC doesn't have other texts of laws in force.

8. Industry Efforts in Minimisation of Hazwastes

Currently industries include themselves like judges and parts in the hazardous wastes management that they produce on the subject for lack of the statutory and legislative texts.

9. Public Awareness of Hazwastes issues

No sensitization of the public to hazardous wastes misdemeanors is not undertaken to some level that it is.

10.National needs for achieving Environmentally sound Management of Hazwastes.

- building of capacities
- technical and financial means
- texts of laws
- sensitization of the public and decision-makers
- inventories of sites of hazardous wastes stockage/landfill
- inventories of sites contaminated
- partnership with the NGOs
- partnership with industrials
- verification of allegations on possible imports of hazardous wastes in DRC
- carry of studies on environmental impacts in DRC

ETHIOPIAN EXPERIENCE ON OBSOLETE PESTICIDE DISPOSAL

BY MOHAMMED ALI

Survey and Evaluation of Data

- The Ethiopian Ministry of Agriculture(MoA) took the initiative
- Budget and resource was allocated to complete a national inventory
- Assistance/guidance was supplied by FAO
- An initial inventory was completed by the Federal Ministry of Agriculture in 1996
- At the time it was believed this gave a complete picture of the situation in Ethiopia.

Survey and Evaluation of Data

- Why was this done?
  - To determine which pesticides were obsolete;
  - To obtain accurate information on the scale of the problem;
  - To identify sites in need of immediate action and stabilization;
  - To assist in the formulation of strategy to deal with the problem;
  - To assist in the identification of a suitable disposal option and to prepare disposal plan.

Survey and Evaluation of Data

- The inventory should contain all basic information according to the FAO format and field information procedures

Survey and Evaluation of Data

- The data obtained showed accumulation of waste had taken place over 40 years
- The data showed different owners of stocks
- The data proved the existence of many badly affected stores and sites
- The data indicated large quantities of banned pesticides and POPs

Survey and Evaluation of Data

- Over 350 tones of POP Pesticides were identified.

POP Pesticides	Quantity/Tone
Aldrin	7.3
BHC	61.8
BHC Oil	83.6
Chlordane	26.1
DDT	77.5
Dieldrin	32.9
HCH	60.7
Heptachior	3.2

Survey and Evaluation of data

- Possible gaps for POP Inventory
    - Inventory limited to pesticides only
    - Those not declared are not included
- **Therefore, further assessment is important**

Survey and Evaluation of Data

- The causes for accumulation in Ethiopia were identified as being:
    - Uncoordinated donations
    - Poor storage and lack of proper management
    - Inappropriate formulation and package size
    - Product deterioration due to extended storage
    - Lack of legal control in the country in the past
    - Poor assessment of pesticide requirement

Survey and Evaluation of Data

- The data showed the existence of over 120 different types of pesticides
- A total of 1,223 tones of obsolete were identified including heavily contaminated soil and empty containers
    - 1152 tones obsolete pesticides
    - 71 tones of heavily contaminated soil and containers
- The total number of affected stores was confirmed as 452.

Disposal Options For Ethiopia

- There are no easy disposal methods that are cheap, safe and applicable for such bulk quantities of obsoletes
- Large quantities of hazardous waste requiring environmentally sound disposal
- Decided that local landfill was not an option
- Decided that cost for development of a local incinerator was too high.

Disposal Options for Ethiopia

- Use of local cement kiln was not acceptable because:
  - No local monitoring capacity
  - No legislation/enforcement/experience
  - No desire from the cement kiln companies
  - Cement kilns are designed to make cement
- Alternative technologies were not available

Disposal Options for Ethiopia

- High temperature incineration method for the disposal of obsoletes in Ethiopia was considered as the best option, though it has its own limitation
- No licensed high temperature incinerator was available in Africa (Southern Hemisphere)
- Environmentally sound and dedicated incinerators accepting waste were available in Europe

Securing Donor Support

- Ethiopian government convinced that it was a matter of high priority and considered as one of the major issues among the list of national concerns which required quick action
- A draft budget for destruction was prepared by the MoA (US$ 3 Million)
- The cost of destroying the identified stocks was too high for Ethiopia to bear
- Therefore donor support was needed if the problem was to be addressed

Securing Donor Support

- International organizations (FAO, GTZ, SIDA and others) were approached for assistance
- Quick response from **FAO**
- With the coordination of FAO, SIDA sponsored a **TASK FORCE MISSION** to Ethiopia constituting different experts from various disposal background in December 1998

Securing Donor Support

- The team confirmed the worst fears of the issue
- Total quantity confirmed initially came up to 1,500 tonnes
- Initial cost for disposal was estimated at 4.5 Million US$
- Project Document Generated and submitted to donors for financial support
- Completion of a Full Environmental Risk assessment of the Project was undertaken

Securing Donor support

- Donors meeting held in Addis Ababa in December 1998
- Pledges were made:

-	USAID	1 M USD
-	Netherlands	2.25 M USD
-	Sweden	1.25 M USD
-	GCPF/CROP LIFE	1 USD/l or kg

- All have responded right away based on their commitment except Crop Life international.

Country Obligations and Contributions

- High level institution support (Ministerial level)
- Ensuring all holders of obsolete pesticides declare their stocks
- Public awareness campaign (radio, mass media)
- allocation of national counter part budget
- Ratification of Basal Convention for the trans-boundary movement of wastes
- Assignment of senior project counter part staff-dedicated full time for the project activity and follow ups
- Provision of office spaces at the ministry of agriculture
- Co-ordination and working linkage with Regional agricultural Bureaus
- General co-ordination of all and relevant activities

Country Obligations and Contributions

- Make the process participatory
- Assistance in the establishment of a National Project Coordination Committee
- Stakeholders include:
    - Environment Authority
    - Ministry of Health
    - Ministry of Economic Cooperation
    - Manufacturers
    - NGOs

Project Components

- Training
- Disposal of the existing obsolete
- Prevention of future accumulation
- Raising awareness among the society
- Capacity building

Project Management

- The Project is a joint undertaking between FAO and MoA - Operation started in April 2000
- FAO provided a Project Manager
- MoA provided two Federal counterparts
- The Project Management office remained responsible for all aspect of Project implementation and execution
- MoA facilitated the provision of an additional 20 Regional counterparts

Project Management

- The management decisions are done in collaboration of stakeholders
- Additional MoA Departmental Committee has been established to assist in the process
- Monthly management meetings held with the disposal contractor to assess progress and to set work plans for actions ahead
- An external monitoring of the Project by an independent international NGO monitor ensured

Performed Activities

- The project covers Prevention and Disposal
- The re-inventory identified 2,500 tonnes of obsolete stocks
- In addition there 400 tonnes of stocks with extended shelf life were reassessed
- A minimum of 1000 tonnes of heavily contaminated soil was identified and confirmed
- A minimum of 300 - 400 tonnes of contaminated containers and spray equipment were identified

Performed Activities

- A contract for the initial estimate of 1500 tonnes has been established
- An international hazardous waste contractor (Ekokem) from Finland has been selected through international tender
- A total of 1,575 tonnes has already been repackaged
- All the repackaged quantities have already reached Finland for incineration.

Performed Activities

- Over 900 tonnes of stocks are already verified as Crop Life stocks
- No contribution has been made as of (January 2004)

Performed Activities

- For the implementation of the Second Phase of disposal operation, agreements were signed between

- Gov of Ethiopia and Belgium
- Gov of Ethiopia and Finland
- Gov of Ethiopia and Japan
- Ministry of Agriculture and FAO

Capacity Building Components

- FAO trained 40 Ministry personnel (Federal and Regional) for re-inventory operation
- Training of Federal Counterparts undertaken by FAO Project Manager
- Pesticide analytical laboratory upgraded
- On-job training for lab. Technicians and analytical chemists completed

Capacity Building Components

- Additional training of 25 selected counterparts: by EKOKEM Company on:
  - Health and Safety training (US OSHA Hazardous Materials)
  - First Aid (international Red Cross)
  - Labeling and Packaging (international Maritime Dangerous Goods Code IMDG)
- Counterparts are given extensive responsibility for supervision of field activities and the international contractor

Future Plans and Concerns

- Additional donor support has now been confirmed
- Preparations is undergoing for the start of Phase II
- Plans to update training of counterparts before the start of phase-II operation is being examined
- Review of strategic working plan is understudy
- Identification of competent disposal company will begin soon through international tender.

Future Plans and Concerns

- Personnel involved in the Project are now more aware of the issues of obsolete pesticides and will assist in preventing future accumulation on the ground
- Plans to review and further upgrade laboratory operation in association with GTZ and potential UNEP Chemicals project.

Summary

- A country must take the initiative on its own rather than waiting for others to initiate
- Nothing can be achieved without the necessary financial resource, budget and training

Summary

- The data collected must be accurate to allow a firm budget to be developed
- The country should be involved from the outset and be involved in all major decisions
- The process can take many years 1996-2002 in Ethiopia.

Summary

- Contributions from Industry although only cover the cost of disposal and can take a very long time to materialise
- Prevention is equally as important as disposal of existing obsolete stocks
- Countries need to assess the needs for pesticides before buying

Summary Review Phase 1

- Started April 2000
- Completed July 2003
- 1507 tonnes removed
- 243 sites cleared

Phase 2 - Distribution of stocks

- 1088 tonnes total
- 405 tonnes in Oromiya
- 209 tonnes in Amhara
- 194 tonnes in SNNP
- 58 tonnes in Somali
- 45 tonnes in Gambela
- Excludes MoH

Phase 2 - Number of sites remaining

- 704 sites in total
- 325 in Oromiya
- 160 in Amhara
- 114 in SNNP
- 83 in Tigray
- Dire Dawa and Harar free from stocks

MANAGEMENT OF HAZARDOUS WASTE IN GHANA

BY JOSEPH AMANKWAA BAFFOE
AND
MR. BENNETT ADJEL

INTRODUCTION

For more than 10 years now, the management of commercial and industrial wastes in Ghana has been of serious concern to the Ghanaian society, public and private organisations/institutions and administrative bodies on different levels. In several attempts, the authorities tried to assess the magnitude of the problem and to design strategies for appropriate solutions. However, despite promising steps, the proposals of respective documents and studies were not followed in a way which could have finally led to a rather satisfactory handling of these wastes.

Hazardous wastes are among the most dangerous pollutants released into the environment through human activity. They are highly toxic substances, causing an array of adverse effects, notably death, disease and birth defects, among humans and animals. Being aware that hazardous wastes pose major and increasing threat to human health and the environment, Ghana in 1996, carried out a study on Industrial Hazardous Wastes Management which was part of the World Bank financed Ghana Environmental Resources Management Project (GERMP).

As major sources of information for the study on industrial activities in Ghana, the "Ghana Directory of Industrial Establishments 1988" (Ghana Statistical Service, 1989) was used. The information was based on a country-wide industrial census carried out in 1987. In close co-ordination with needs and requirements of the EPA, industrial branches with a high potential for hazardous waste pollution were identified.

As environmental awareness in industries is rather low, reliable information about types and quantities of hazardous wastes generated is not sufficient. The main generators of hazardous wastes were the Metal Industry, the Textile Industry, Tanneries, Refineries, the Chemical Industry and the Food Processing Industry. However, hazardous wastes were also identified from other sources, such as medical and other health services (e.g. chemicals and infectious materials from hospitals, health care centres, laboratories, veterinary services), commercial and personnel services (e.g. filling stations, photo shops, cosmetic institutions) and, last but not least, private households (e.g. batteries, neon bulbs, remains from paints, lubricants, solvents, pharmaceuticals).

With respect to the difficulties identified a further study was carried out in 2003 on the guidelines for the safe transport, storage, handling and disposal of hazardous waste and obsolete chemicals in Ghana.

Ghana has also signed and adopted the Stockholm Convention on Persistent Organic Pollutants (POPs) on May 23 2001 in Sweden, and ratified it on May 30 2003 and a National Implementation Plan as a formal planning document, which defines Ghana's

commitments, current situation and actions, which it plans to undertake in the fields of POPs management has had its draft report finished in June 2004.

1.1 INDUSTRIAL CONTRIBUTIONS IN DEVELOPMENT

The industry contributed in 2001 with 27.4 % to the Ghanaian GDP and is – beside the sector Services – the fastest growing sector. Within the industry, manufacturing is the dominant activity with a share close to 40 % (2001). The manufacturing sub-sector is rapidly increasing with a growth of more than 26 % in the period 1996 to 2001. The Mining and Quarrying sub-sector with a share of 21 % (2001) recorded in the same period a growth of 15 % only, with growth even slowing down in the last two years. Other sub-sectors are Electricity and Water as well as Construction with a share of 10 respectively 31 %.

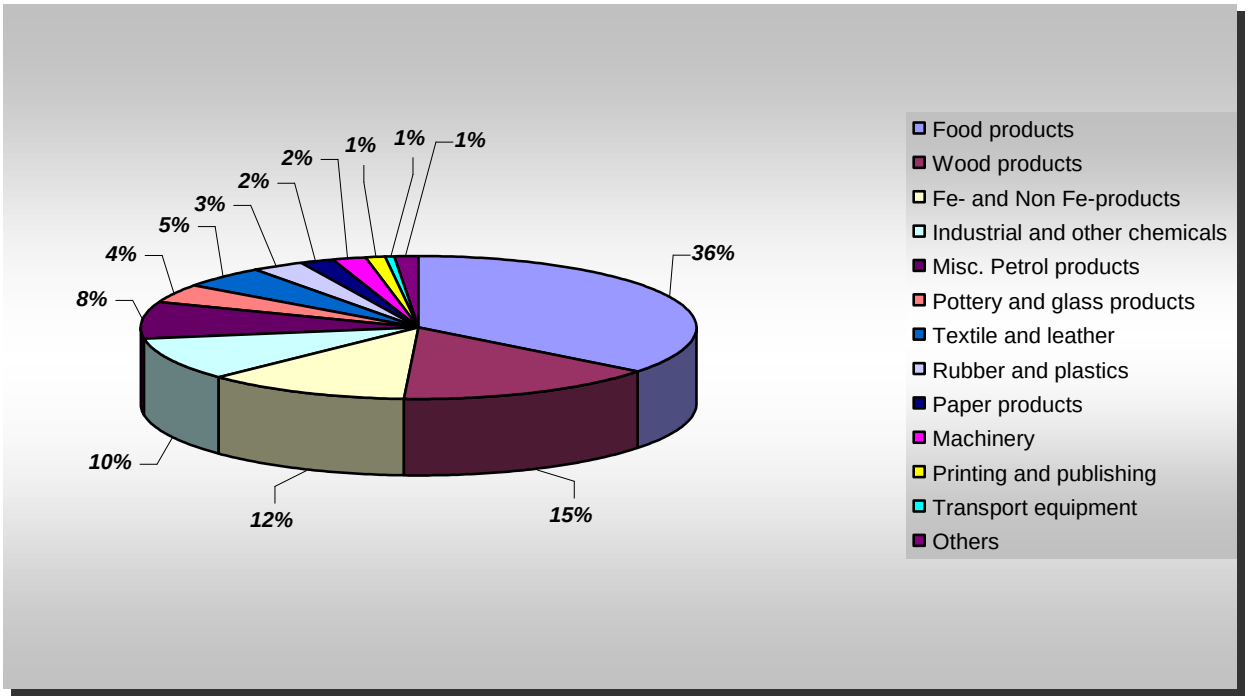


Figure 1: Sub-sectors within the Manufacturing Sub Sector in Ghana, 1995[1]

In the Industry Sector, the Government's policy thrust has been primarily to improve competitiveness with the potential to gain better access to international markets with value added products derived from local resources. Especially the establishment of local resource based micro; small and medium-sized industry is being promoted.

The main objective is to improve the general performance of the Industry Sector and to overcome problems associated with heavy dependence on imported goods and under-utilization of production capacity. Emphasis of the industry policy is on[2]:

- rehabilitation, modernisation, expansion and diversification of the Industry Sector to enhance competitiveness,
- promoting the establishment of new industrial capacities and environmentally sound industrial operations,

[1] UNIDO Country Industrial Statistics – Ghana, UNIDO Reference Information
[2] Information Service of Ministry of Trade and Industry, Accra, 2002

- promoting the local indigenous private sector and involving both, local and foreign private enterprises to a greater degree in the industrial development,
- enhancing the competitiveness of Ghana's goods and services through standardisation.

1.1 Hazardous wastes streams generated in Ghana

In the table below, estimated quantities of industrial waste generation per industrial branch are summarized. The estimates on the expected industrial hazardous wastes were based on the upscale of the current data to 100% employment. Furthermore, the recommended treatment/disposal technologies were named. Due to the poor data base, calculations could only provide a rough assessment of generated waste quantities. Therefore, the estimated generation of about 50,000 t of industrial mixed solid waste, from which 60% are generated in the Accra-Tema Metropolitan region, would have to be verified. There were also (theoretically) about 1,500 t of spent oil, which was usually sold out to the people to be used as fuel, lubricant, for wood preservation etc. In some cases the used engine oil went back to the petrol companies to be re-used as a fuel in the mining industry or industries with boiler facilities. Others are sold to recycling companies.

Table 1: Summary of sources, estimated quantities and recommended types of treatment and disposal of Hazardous Waste

Name of Industry	Hazardous waste types	Municipal Landfill t/a	Re-use and Re-cycling t/a	Chemical-physical Treatment t/a	Mech.-biological Treatment t/a	Incinera-tion t/a	Special Landfill-ing t/a	Special Treat-ment t/a
FOOD & BEVERAGE	Soda lye, laboratory wastes, sludge							
FOOD AND BEVERAGES INDUSTRY 20%		2,000		21	(80)	min	min	
FOOD AND BEVERAGES INDUSTRY 100%		**10,000**	**pos.**	**100**	**(400)**	**no**	**no**	**no**
TEXTILE INDUSTRY	Dyes and solvents							
TEXTILE INDUSTRY 33%		1,100		4.5	n.d.		n.d.	
TEXTILE INDUSTRY 100%		**3,500**	**pos.**	**15**	**needed**	**no**	**needed**	**no**
PETROLEUM INDUSTRY	Oily sludge, waste oil							
PETROLEUM INDUSTRY 100%-		**150**	**pos.**	**needed**	**on site**	**no**	**needed**	
CHEMICAL INDUSTRY	Oil emulsions, organic chemicals, pharmaceutical wastes, spent fuel							
CHEMICAL INDUSTRY 28%		1500		24	n.d.	n.d.		
CHEMICAL INDUSTRY 100%		**5,000**	**pos.**	**100**	**needed**	**min**	**needed**	**no**
PALM OIL PROCESSING INDUSTRY	Sludge							
PALM OIL PROCESSING INDUSTRY. 33%		140		n.d.	-	-	-	-
PALM OIL PROCESSING INDUSTRY 100%		**500**	**pos.**	**needed**	**no**	**no**	**no**	**no**
PAPER INDUSTRY	Solvents from prints, heavy metals							
PAPER_INDUSTRY. vis. 60%		60		n.d.		-	-	-
PAPER_INDUSTRY 100%		**100**	**pos.**	**needed**	**min**	**no**	**no**	**no**
METAL INDUSTRY	Heavy metals, enamel dust and sludge, slag, dross							
METAL_INDUSTRY. vis. 20%		3,300		180	n.d.			
METAL_INDUSTRY 100%		**6,500**	**pos**	**300**	**needed**	**no**	**20,000**	**no**
WOOD PROCESSING INDUSTRY	Solvents							
WOOD PROCESSING INDUSTRY 4.5%				10				
WOOD PROCESSING INDUSTRY 100%		**5,000**	**par. pos.**	**200**	**no**	**no**	**needed**	**no-**
MINING INDUSTRY	CN, Hg							
MINING INDUSTRIES 4.3%				10	n.d.	-	n.d.	n.d.
MINING INDUSTRIES 100%			**par. pos.**	**200**	**needed**	**no**	**needed**	**needed**

1.2 Present Industrial Waste Management

Site visits revealed that enterprises, which were in rather close contact with EPA, had developed at least a basic understanding of environmental problems related to their specific work areas and an appreciable environmental consciousness. This fact can surely be attributed to EPA's approach rather to serve as individual consultant in order to assist in solving the company's environmental problems than to act as a supervisory authority with all its legal and regulative powers. Close monitoring of monthly, quarterly or annual environmental reports attributed additionally to an improvement of the environmental conditions at the premises of some of the companies visited.

1.2.1 Crocodile Machetes - Metal Processing

According to available reports and records, the company's performance with regard to environmental management issues is satisfactory. The company's management complies with EPA's environmental monitoring tools (e. g. monthly and annual environmental reports, obligations provided in the Environmental Action Plan, effluent analyses, etc.), and the flow of the work process itself is clearly oriented towards maximum use of input material and avoidance of unwanted left-overs, residues and scrap. The economic streamlining of the work process yields, somehow as a by-product, environmental improvements at company level. EPA officers are welcome as advisors and clearly not as production-threatening and cost-inflicting administration.

As there are some more regularly carried out inspections (e. g. Health Department of the Tema Municipal Assembly, Ministry of Industry, Fire Prevention Services, etc.), the company management would appreciate if the various inspection services could be monitored through one hand at one time.

1.2.2 Tema Lube Oil Company Limited (TLOC)

TLOC primarily blends lubricants, such as engine oil, hydraulic oil and gear oil for distribution by the oil marketing companies operating in the country. The plant, which has a capacity of 25,400 t of lubricants per annum, produces about 90 % of the country's requirements. Part of TLOC's mission statement is to pursue sound and sustainable environmental practices in its operations.

In furtherance of this objective, the company has invested into an effluent treatment plant, which was commissioned in October, 2002. The combination of a coalescer plate oil-water separator and a bacteria-charged bio filter module ensures that trace oils and organic pollutants in the factory effluents are reduced substantially to levels below the Ghanaian national regulatory thresholds.

1.2.3 FIDEV Company Limited

FIDEV Company Limited is specialised in recycling vehicle parts like batteries, engines, alternators etc., with the aim to reuse or sell the recovered material, e.g.

- copper: sale for export,
- plastic boxes of batteries: sale to local recycling enterprises,
- aluminium: production of ladles directly at the recycling yard.

Recycling operations at this plant are very basic, and besides technical and operational problems, there is an immense lack of environmental consciousness. Liquids inside the vehicle parts, like waste oil or acids, mainly are dumped on the ground, they seep into the sub-ground or are washed into the nearest open drain with direct access to the Odaw River and the Korle Lagoon. No precautions or storage/collection systems for solid or liquid industrial waste were found on the company's premises.

Although the developed business idea of recycling vehicle parts containing hazardous material is highly welcome in Ghana, basic principles of environmental protection have to be followed, with this particular case, significant improvements could be achieved with limited financial input.

Immediate improvements of the environmental conditions could be achieved by the

- concentration and limitation of immediate work areas,
- provision of roofing at the immediate work and storage areas,
- provision of impermeable, inclined floor conditions for work areas and storage areas for accumulated recycled goods,
- provision of a sump and drums for the collection and intermediate storage of liquid waste from the operations,
- desilting and covering of gutters on the company's premises,
- provision of protective clothing for the staff.

Together with operational streamlining and improvements, the above measures would decrease significantly the environmental hazards from this plant.

1.2.4 Allied Fuels Limited

Allied Fuels Limited converts waste oil into useable oil for the industry. The project provides for the construction of a plant for the processing of 2,000 m^3/yr waste oil (approx. 20% of the estimated annual waste oil generation in the Accra-Tema area, with calculations based on current sale of lubricants). The waste oil is collected by Allied Fuels Limited from major waste oil generators in the Accra-Tema area (e.g. service stations with more than 1,000 litres per month). Key sector actors, like Shell Oil, Mobil Oil, Elf, the State Transport Company, AMA, VRA, and the Tema Harbour Authority etc. utilise and support the infrastructure.

Tankers would discharge waste oil into a decantation tank; the oil is then filtered into a waste oil holding tank. A defined quantity of waste oil is drawn into the ReTec machine for processing: heating, centrifuging, filtering and blending. Four parts of the processed oil would be blended with one part of kerosene. The product finally passes into a water separator unit, where any remaining water is removed, and a very fine filter delivers the final polish to the blended fuel (eco-fuel).

1.2.5 Others

Different information sources indicated the operation of low-level treatment facilities/activities for acids and waste oil. The described waste oil treatment activities covered operations like

- burning untreated waste oil in furnaces,
- using waste oil as a creosote replacement for timber protection,
- laying waste oil on dirt roads to suppress dust,
- adding waste oil to gas oil to increase volume,
- re-using lubrication oil for back street garage operations,
- burning untreated waste oil in the fish processing industry.

All these activities do not comply with recognised environmental standards in Ghana and must be discouraged and discarded.

1.2.6 Hospital Waste Incineration at Korle-Bu Teaching Hospital

On the hospital's premises, an incineration facility with two independent incineration units has been installed to take care of the final treatment/disposal of health care waste. The incinerator with an operation temperature of up to maximum of 1,200 °C is used only for the treatment of wastes from the various operation theatres of the hospital (e. g. body parts). The two incineration units are operated alternately during only one working session per day. However incineration is limited because the additional fuel to run the incinerator would be too expensive.

All other health care waste, including potentially infectious waste, is collected by hospital personnel, stored in plastic containers on the hospital's premises, collected on behalf of Accra's WMD and disposed of at the Oblogo landfill site.

A waste segregation at the source, according to the inherent hazard potential of the different fractions of health care waste, is carried out only rudimental. The same applies to further management principles for health care waste as laid down and recommended in the respective guideline of EPA.

The following have however been recommended

- incineration of all those types of health care waste which require this treatment due to their inherent hazard potential,
- a suitable mixture of body parts, placentas etc. with dressings, plastics etc. will increase the calorific value of the incineration charges and thus reduce the use of supporting and stabilising additional fuel,
- utilisation of the full operation capacity of the incineration facility.

1.2.7 Plans for Cleaner Production Technologies at the TEPZ

The Gateway Project for the Tema Export Processing Zone (TEPZ) intends to start a Cleaner Production and Business Sustainability Centre at the TEPZ in near the future. The Cleaner Production Centre (CPC) will target at waste minimisation, elimination and control at the source (enclave tenants). However, if suitable and applicable, any good management system developed at the Tema Cleaner Production Centre could be introduced at national level.

Acknowledging this, the World Bank has allowed using part of the project funds for the construction and installation of the CPC and for the training of EPA staff, consultants and industries in cleaner production technologies. The Gateway project office is currently working out a policy proposal on redefining and mainstreaming cleaner production into the existing industrial and environmental waste management policies of Ghana. This will include the establishment of a "CP-fund" to serve as initial seed money/loan to industries undertaking CP, a performance rating, public disclosure of CP candidates' performance to boost corporate image and a success reward system. The CPC will involve processing and application of data from the industries and practical successful industrial case studies to solving similar industrial problems, as well as include CP technology information into project feasibility studies and business plans for industry at affordable costs and minimal charge for training of industry staff in CP options identification.

In September 2002 a UNIDO Cleaner Production demonstration project with workshops was organized together with 15 company's audit reports and their respective case studies are the final outputs for the proposed cleaner production center.

The project comprised the reduction of industrial wastewater, which is discharged in the Korle and Chemu II lagoons. 16 companies of which 8 food processing, 3 textile, 3 metal working, 1 paint, 1 pharmaceutical and 1 paper processing, have been selected to participate in a CP demonstration project to demonstrate the applicability of CP in the Ghanaian industry. During the course of the project one company dropped out. The wastewater discharged by these companies reached approx. 2.7 million m^3/yr in 2000 and contained high concentrations of pollutants expressed in BOD, COD, SS, etc. In order to support those companies local experts (8) and company staff have been trained to execute the CP assessment.

The pre-assessment revealed that most of the causes of waste and inefficiencies were related to the choice and status of the technology, process efficiency, operating practices and low level of (production) management. Upon completion of the assessments these companies have generated 297 CP opportunities, which aim to reduce the raw materials, water and energy consumption and generate economical benefits. These options can roughly be divided into 31% software, i.e., improvements of workers and management, 33% hardware, i.e., technology change, equipment modification and process optimisation and 26 % in reusing of waste, changing input materials and changing products. Of these options 48% were considered of no and low cost, 29% medium and 23% of high cost. At the end of the project 36% of the options have been implemented and 20% are under implementation. 25% of the options are under investigation and 19% have either been rejected or are further research postponed due to lack of information.

On 44 options feasibility studies have been performed which show that 51% of the investments have a payback period of less then a year, 40% have a payback period between 1 and 3 years and 9% have a payback period longer then 3 years.

Although a definite figure cannot be established, as there is some confusion on actual and envisioned investment so far the 15 companies appear to have invested approximately 195.000 USD, which generated approximately 815.000 USD annually. Furthermore apart from reductions in solid waste, raw material and energy consumption also approximately 0.8 million m^3/yr wastewater discharges have been reduced. BOD,

COD, TSS have been reduced due to higher process efficiencies. Further investments and significant wastewater reductions are anticipated.

1.2.8 Landfill Site for Municipal Solid Waste - Kpone Landfill - Tema

The Kpone landfill is a simple site for the disposal of municipal solid waste, without any groundwater protection facilities or other requirements for hazardous waste landfilling. The incoming waste quantity is estimated by the manager, the installed weighbridge is not operational. Screening of waste is not carried out by the operation personnel.

Waste, dumped by the collection vehicles, is pushed by a dozer to a designated landfill cell and piled up to heaps of 6-7m high. The heaps are not compacted. Few fires continued burning, even after rainy days, and some piles of ashes on the landfill area gave an indication that waste was set aflame purposely. Scavengers sourced out different waste fractions for sale to external recycling traders.

According to information from the Waste Management Department (WMD) of the Tema Municipal Assembly (TMA), industrial waste is disposed of at this landfill. It is thus very likely that hazardous industrial waste is buried at the landfill without pre-treatment or other precaution measures.

The landfill organisation is not based on an approved disposal management plan.

Recommendations here are that the management of the Tema landfill site could be optimised through a package of small measures in the operation:

- organisation of the reception of the waste (reinstallation of the weighbridge)
- inspection of the kind of delivered Waste (hazardous Wastes?)
- use of the small caterpillar for the compressing the Waste
- construction of the landfill in layers
- design of a operating plan
- capacitating of the landfill operator

With respect of hazardous wastes there is the need of the installation of special disposal sites.

1.2.9 Landfill Site for Municipal Solid Waste - Oblogo Landfill - Accra

In early 2000, the Mallam landfill had to close down after more than 9 years of operations. Although the Waste Management Department (WMD) of the Accra Metropolitan Assembly (AMA) had identified a suitable location for future waste disposal operations (Kwabenya) as far back as 1994, the new site could not be developed in time. In January 2001, AMA/WMD commenced disposal operations at Oblogo. The site provides disposal volume for some few years and is regarded an interim solution.

Figure 2: Operations at Oblogo landfill

The landfill is located at a closed quarry, which consists of quartzite and schist. Due to stone quarrying and associated extensive use of explosives in blasting, the rocks look highly fractured and fissured so that a 50 cm thick compacted clay layer was necessary to achieve sub-ground permeability of about 10^{-9}m/s.

1.2.10 Waste Water (Sewage) Treatment Plant – Accra

In 2001, AMA commissioned a sewage treatment plant financed by the British government. The plant has a design capacity of 16,120 m^3/d, including 40 m^3/d of night soil from communal intermediate storage facilities.

Sewage and night soil flow into the plant from the existing sewerage system of Central Accra and 5 satellite pumping stations. After passing inlet works and grit channel, the untreated sewage is channelled through primary, secondary and tertiary distribution boxes that ensure equal distribution into the six reactor cells.

Anaerobic digestion of the sewage takes place and the gas generated is collected in the gas hoods and later fed to the combustion flare stack. Excess sludge produced by the anaerobic reaction is periodically drawn off into the sludge thickener and after 24hours pumped to the sludge drying beds. Effluent flow is by gravity from effluent weir to the trickling filter and afterwards to the final settlement tanks. The polished effluent is discharged through the works outfall into Korle Lagoon.

Figure 3: Sewage treatment plant, Accra

Currently, the plant is not utilised with its full potential: average operations cover only between 30% and 40% of installed capacity. Only 700 customers (incl. 16 industries) are connected to the sewer lines of Accra.

The plant is well equipped, orderly kept and adequately staffed. According to records of the plant management, the plant performance is satisfactory and effective (influent BOD 200 mg/l, effluent BOD 20 mg/l).

Some recommendations suggested to maximize utilization

- massive extension of services (new connections of commercial/industrial enterprises to existing sewer lines),
- preparation of industry standards for the indirect discharge into water bodies,
- adequate integration of the waste water sector into the public waste management units on district/municipal/metropolitan levels,
- education and training for industrial customers on use of the facility,
- installation of monitoring and control mechanisms.

With regard to the individual techniques, the following observations are made:

a) Dumping -

Many factories collect and dispose off their solid wastes near the factory premises, often directly behind their fence wall. These areas often develop to unhygienic breeding grounds for various forms of diseases and can cause groundwater and soil pollution. Often, wastes are openly dumped and burnt, creating smoke and local air pollution. The

smoke can also be toxic to both human health and the environment. In most cases, these dumps are not fenced and, therefore, regularly visited by scavengers to retrieve valuable materials from the wastes, often not being aware on the health risks.

b) Incineration -

Various types of incinerators are used by many enterprises, where all combustible waste materials like paper, cardboard, textiles, etc. are burnt. This method of waste treatment in most of the cases cannot be accepted from the environmental viewpoint because of the very poor standard of the technical equipment used. Usually gas cleaning equipment does not exist and the desired high temperatures during incineration are not ensured. As a result, many remaining out gaseous and solid particulates are distributed to the environment. Furthermore, mostly the chimney stacks are too short.

c) Landfilling -

In some cases, the respective Metropolitan Assemblies collect solid wastes from industrial enterprises. These wastes are disposed off to designated municipal landfill sites for a tipping fee. Industries which do not benefit from the collection service often bring their wastes to municipal landfill sites. In general, at the landfill sites no safety equipment and monitoring systems are provided to protect the environment against leachate, odour, particles, germs and gaseous emissions. The landfills are not monitored to check their stability, to prevent fire, distribution of wastes by animals and wind. There are usually no control on materials delivered and regulations about the type of co-disposal of various types of industrial and household wastes.

d) Recycling and Re-use -

Most of the recyclable waste materials from manufacturing companies are further processed by small scale industries and the informal sector. Depending on the relatively high prices of raw materials and the cheap labour force, recycling is very well developed in Ghana. Generally, two types of recycling activities are described:

i. Re-use of raw materials in the chemical, textile, paper and wood processing industry: For example, Metalloplastica (Gh) Limited, re-melt their defective buckets, toys and other products for processing into new products. Similarly the Super Paper Product Company Limited re-pulps the defective papers and tissues into new products. Also Cemonit Limited recycles internal non-hardened remainings back. Novotex Limited is producing chipboards from wooden off cuts.

ii. Wastes sold out and used as raw material for other products: For example, various textile industries, sell wastes from cotton grading to pillow manufacturers, sawmills sell off-cuts to charcoal burners and all the breweries sell broken and rejected bottles to a glass factory in Tarkwa-Aboso. From other companies, waste paper and cardboard is delivered to Super Paper Products Co. Ltd. and metal scrap to the scrap processing companies like Tema Steel Co. Ltd and Western Castings Ltd. Furthermore, spent lubrication oil is collected by the petrol companies and used as a fuel in other sectors, for example, in the mining industry.

e) Physical-Chemical Treatment -

Practices and techniques for Physical-Chemical Treatment of wastes are not very common in the country. Most of the chemical wastes are not treated. In the case of the Petroleum Industry API separators are available to reduce oily effluents. In the Food and Beverages Industry very simple fat traps are used to recover oils, fats and grease from the waste water effluent.

2.0 ENVIRONMENTAL AND HEALTH IMPACTS

2.1 Water bodies

The industries in Ghana utilise large quantities of water, hence, they generate large volumes of liquid effluents, potentially causing pollution in the receiving water bodies. Some of the pollutants may be extremely hazardous or toxic. Currently, there is very little information available on the quantity and quality of domestic and industrial effluents in the country. Most of the liquid discharges are usually not monitored.

Due to the concentration of industrial enterprises, the following core areas are prone to industrial pollution ca in Ghana:

- In *Accra*, most of the industries are located within the catchment area of *River Odaw and the Korle Lagoon* into which waste water effluents are discharged.

- In *Tema*, the *Chemu Lagoon* receives most of the industrial waste water effluents. Some industries directly discharge into an underground sewerage system which leads (through an outfall about 1 km offshore) directly to the open sea. It has to be considered, that this outfall currently has completely broken down.

- In the Ashanti Region, most of the industries are located in *Kumasi*. Effluents from these industries are discharged into the *River Sisai and the tributary rivers Subin and Aboabo*.

- In the *Western Region*, where most of the enterprises are situated in the industrial zone of *Sekondi-Takoradi*; their waste water effluents are discharged into a *swampy area* nearby.

In other regions of the country, industrial effluents are currently discharged into nearby water bodies.

With regards to the quality of industrial effluents it has to be stated, that in nearly all cases, effluents are discharged without any pre-treatment, substantially increasing the pollution levels of the water bodies concerned. Few companies, like Gihoc Pharmaceuticals Co. Ltd., Juapong Textile Ltd. and Akosombo Textiles Ltd. treat their effluents in treatment plants before discharging into nearby water bodies. However, most of these plants are far from working efficiently.

In the urban areas of the country, the *discharge of used oil* into drains and surface water bodies substantially contribute to the reduction of their natural oxygen levels. For Accra, for example, according to estimates, small garages and car workshops discharge about 500 gallons used oil per day (approx. 2.5 t/d) into the catchment system of the Korle Lagoon which consequently results in adverse impacts on the entire ecosystem. In relation to the regional concentration of the major industries and in accordance with the

needs and interests of the EPA, the pollution of the most relevant surface water bodies receiving industrial discharges is not assessed.

Table 2: Estimate on Population Equivalent of Total Industrial Effluents in Ghana

Industrial Branch	Waste water effluent m³/a	BOD_5 load (estimated) kg/d	Population Equivalent (estimated) (PE) 56 g BOD_5/PE.d N
Food & Beverages Industry 100%	5.000,000	17,500	> 300,000
Textile Industry 100%	9.000,000	7,500	> 150,000
Chemical Industry 100%	500,000	3,000	> 50,000
Petroleum Industry 100%	770,000	850	> 30,000
Palm Oil Processing Industry 100%	750,000	120	> 3,000
Paper Industry 100%	700,000	1000	> 17,000
Metal Industry 100%	2.500,000	2800	> 55,000
Wood Processing Industry 100%	1.000,000	1000	> 20,000
Miscellaneous Industries 100%	1.200,000	2000	> 5,000
TOTAL GHANA INDUSTRY	21.420,000	40,000	> 700,000

2.2 Gaseous Emissions

Most of the emission of SO_X and NO_X from manufacturing industries is obviously caused by burning mineral fuels. In most cases, the emissions are low due to relatively low energy consumption. There are, however, some areas, where measures have to be taken in order to reduce emissions, especially in such companies, where wood or wood-based fuel is used. There, the main concerns are the smoke emission.

2.2.1 Estimate on Total Industrial Air Emissions in Ghana

The following tables show the estimated air emission quantities for the entire industrial sector split into different industrial branches.

Table 3: Estimate on Total Industrial Air Emissions in Ghana

	Estimation of emissions (t/a)			
Type of industry	NOx	Sox	Dust (PM)	CO2
Food & Beverages	2,500	1,000	150	400,000
Textile Ind.	250	120	20	50,000
Chemical Ind.	900	450	100	210,000
Petroleum Ind.	300	100	27	120,000
Metal Ind.	400	200	900	7,200
Paper Ind.	./.	./.	./.	./.
Palm Oil Processing	20	./.	350	100,000
Wood Processing	60	./.	800	240,000
Charcoal Production	1,000	./.	22,000	7,000.000
Miscellaneous Industries	500	200	30	80,000
Burning of old lub oil	360	132	60	78,000
Total Industrial Emissions	6,290	2,202	24,437	8,285,200

Table 4: Composition of Estimated Air Emissions and Contribution of Industrial Emissions to Total Emissions

	Estimation of emissions (t/a)			
Type of emissions	NOx	Sox	Dust	CO_2
Total emissions by fuel consumption (Mineral oil, fire wood, charcoal,) incl. private use, small scale industries and vehicles	13,000	6,700	49,000	18,200,000
Total industrial emissions	6,290	2,202	24,437	8,285,200
Contribution of Industrial Emissions to Total Emissions	48%	33%	50%	46%

Hazardous waste in Ghana has had effects on human and animal health through different mechanism and routes of exposure. The most obvious route is direct contact with the hazardous agent during the handling of wastes. Indirect exposure to hazardous substances (e.g. via empty containers, jars or bags left at disposal sites, dropped during transportation or re-used without proper cleaning) bear the same risks. Children have especially been vulnerable as they play around waste bins etc. and may put fingers or contaminated articles in their mouths. Inhalation of dust from waste storage or dumping sites has also constituted a hazard. Groundwater has been contaminated from dumping sites and landfills. Hazardous agents are transferred to drinking water. The conveyance of contaminants into surface water has often resulted in a rapid and extensive dispersion and substantially increase the number of the population exposed. Sea birds and other animals contribute to the dispersion of bacteria, contagious diseases and other contamination of drinking water reservoirs and directly to households.

Furthermore, leachate from disposal sites as well as atmospheric deposition has lead to the absorption of chemicals by organisms and to the accumulation of toxic substances in food chains.

However, substantive research has not been carried out to identify the direct health impacts resulting from hazardous waste pollution.

3.0 NATIONAL INSTITUTIONAL AND REGULATORY FRAMEWORK

The Environmental Protection Agencies Environmental Action Plan (EAP) sets policy actions related to investment and institutional strengthening activities to make Ghana's development strategy more environmentally sustainable. The areas directly linked to the EAP are

- Land management
- Water management
- Marine and coastal systems
- Industrial pollution
- Mining
- Hazardous chemicals management
- Human settlements.

This action plan from which was carved the National Environmental Policy, was published in 1990. The ultimate aim of this national policy is to improve the surroundings, living conditions and the quality of life of the entire citizenry, both present and future. The policy, specifically, seeks to:

- Maintain the ecosystems and ecological processes essential for the functioning of the biosphere;
- Ensure sound management of natural resources and the environment; adequately protect humans, animals and plants, their biological communities and habitats against harmful impacts and destructive practices, and preserve biological diversity;
- Guide development in accordance with quality requirements to prevent, reduce, and as far as possible, eliminate pollution and nuisances;
- Integrate environmental considerations in sectoral structural and socio-economic planning at the national, regional, district and grass roots levels;
- Seek common solutions to environmental problems in West Africa, Africa and the world at large.

There is no national policy framework for the management of hazardous waste in Ghana therefore leading to inadequate and incapability of dealing with the specific requirements of the Basel and Bamako Conventions on transboundary movement of hazardous waste. There is therefore the need for a comprehensive legislation to deal with hazardous waste.

There are a number of laws that have some relevance to hazardous waste management.

Many of these laws however, do not address the dangers posed to humans and the environment by the waste in question. Where they may be relevant, the institutions that deal with them do not have the resources to monitor or research into their disposal as required by the Convention.

A framework exists for multi-sectoral collaboration in the control and management of hazardous waste in the country. With the EPA as the coordinating center, Ministries, Departments and Agencies (MDAs) such as the Plant Protection and Regulatory Services Directorate (PPRSD) of the Ministry of Food and Agriculture, the Ghana Standards Board, the Ghana Atomic Energy Commission, the Customs, Excise and Preventive Service, the Minerals Commission, the Ministry of Health/Ghana Health Service, the Food and Drugs Board, NGOs and the universities and research institutions participate in committee meetings aimed at sound hazardous waste management in the country.

4.0 EXISTING LAWS AND REGULATIONS

At present, there is no specific legislation on industrial waste or hazardous waste management at the national level in Ghana. However, some environmental laws and regulations deal with general issues of waste management. At the local level, there are a few bye-laws (partly as draft bye-laws) which regulate waste management (mainly municipal solid waste and human excreta) in their respective areas of jurisdiction.

As required by its Policy Statement on the Environment, the Government of Ghana is expected to "take appropriate measures, irrespective of the existing levels of environmental pollution and extent of degradation, to control hazardous waste pollution.

- The Environmental Protection Agency Act, (Act 490) of 1994. This Act which established the Environmental Protection Agency, seeks among other things to control the volumes, types, constituents and effects of waste discharges, emissions, deposits or other sources of pollutants and/or substances which are hazardous or potentially dangerous to the quality of life, human health and the environment through the issuance of environmental permits and pollution abatement notices.
- The Pesticides Control and Management Act, 1996 (Act 528), provides rules for registration, manufacturing, use, disposal and non-disclosure of information, classification, licensing, reporting, labelling and inspections of pesticides.

Although these laws are not specific to the hazardous waste, they provide a framework for the management of all chemicals and pesticides, which includes POPs. Other chemical related laws in operation in the country include:

- The Food and Drugs Law, 1992, (PNDCL 305B) which was enacted to control the manufacture, import, export, distribution, sale, use and advertisement of foods, drugs, cosmetics, household chemicals and medical devices. Drugs, cosmetics and household chemicals are made from several chemical substances that may have a negative impact on health and environment if the manufacture, distribution and disposal are not controlled and managed properly.
- The Factories, Offices and Shops Act, (Act 328) 1970, which seeks to protect the health and safety of workers from the dangers posed by chemicals to employees in the working environment;
- The Standards Decree, 1973 (NRCD 173)
- The Draft Policy and Bill on Occupational Safety and Health, 2000 which seeks to ensure that measures are instituted to ensure the attainment of optimum health for workers in all occupations in Ghana.
- The Mercury Law, 1989
- The Minerals (Off-Shore) Regulations, 1962 (as amended)
- The Oil in Navigable Waters Act, 1964
- The Standards Decree, 1973 (NRCD 173)
- Infectious Disease Ordinance (Cap 78)
- The Prevention and Control of Pests and Diseases of Plants Act, 1965 (Act 307).
- Prevention of Damage by Pests Decree, 1968 (NLCD 245)
- Cocoa Industry Regulations, 1968 (NLCD 278).
- Merchant Shipping (Dangerous Goods) Rules, 1974 (LI 971)
- Customs, Excise and Preventive Service Law,
- Local Government Act, 1992 (Act 458)
- Export and Import Act, 1995 (Act 528).
- Environmental Assessment Regulations, 1999 (LI 1652)

5.0 PUBLIC AWARENESS OF HAZARDOUS WASTE ISSUES

According to Ghana's Environmental Action Plan, the success of any environmental policy depends on the fact that all sections of the population understand the functioning of the environment and the problems it presents. The implication of this is that Environmental Education should reach all sectors of the community. To this end, continuous and detailed education programmes are being implemented at all levels of

society so that every Ghanaian becomes aware of the problem and fully assumes responsibility in safeguarding the environment. In the formal system Environmental Education has been integrated into the curriculum of schools.

In the non-formal system, sustained efforts are being made to promote awareness among policy makers to provide training for resource managers at appropriate levels, and promote greater public awareness and motivation for environmental action. Indeed there are sectors responsible for providing education in all forms throughout the country.

Some of these institutions and organisations are:

- Non Governmental Organisations (NGOs), Community Based Organisation (CBOs)
- Ghana Education Service
- District Assemblies
- Media
- Religious Organisations or Faith Based Organisations
- Universities and Research Institutions
- Traditional Institutions

These institutions have various means of disseminating information to the public. However the desired impacts of some of this information dissemination have not been assessed.

In Ghana proponents who want to carry out some undertakings are required by the Environmental Assessment Regulations of 1999 (LI 1652), to undertake an appropriate level of environmental assessment of their projects. The Regulations provide a list of the projects for which Environmental Impact Assessment (EIA) is mandatory before commencement of work

The regulation encompasses projects for which EIA is mandatory. It includes agriculture, drainage and irrigation, airports, land reclamation, fisheries, forestry, housing, ports, petroleum, power generation and transmission, water supply, chemical and metal industry, and large-scale mining. Every undertaking/development that may have an impact on the environment is therefore required to be registered with the EPA.

Nationally, the government public information policy and practice related to the environment have been embedded in various laws and legislation. The major ones are Act 490, LI 1652 and Act 528. Additionally, some institutional policies on the Environment, Forest, etc have been documented as earlier mentioned.

In the formal system the EPA in collaboration with the Ministry of Education, integrated Environmental Education into the syllabus of schools. Environmental themes/topics are therefore taught in schools and colleges.

In the non-formal sector the EPA conducts seminars, training, publishes reports on the environment, publishes Newsletters and carries out environmental awareness campaigns to the general public including exhibitions.

6.0 HAZARDOUS WASTE CONTAMINATED SITE AND REMEDIATION CATALOGUE

Ghana has no comprehensive studies of all hazardous waste contaminated sites. A few sites have been assessed and with the tremendous high industrial growth rate there is therefore the need to conduct another extensive research into this area.

Since Ghana treats and disposes off both hazardous and non hazardous waste similarly, a number of urban sites in the country with regard to land filling have been inadequately decommissioned and no remediation activities have been executed.

7.0 NATIONAL NEEDS FOR ACHIEVING ENVIRONMENTALLY SOUND MANAGEMENT OF HAZARDOUS WASTE

The main problems for implementation of the sound management of hazardous waste in Ghana have been identified. These include the following:

- Fragmented legislation
- Inadequate enforcement capacity,
- Limited capacity to review, rationalize, update and integrate environmental laws,

A review of the extent of exposure of the environment in Ghana to hazardous waste was carried out in 1996 and 2003. The study covered the extent to which hazardous waste is an issue in Ghana with regard to production, use, emission, and management.

A number of reviews, evaluations and assessments of hazardous waste sources, regulations on its use, situational analysis in Ghana of hazardous waste in terms of its lifecycle; it's presence in the environment, food, feed and humans; national monitoring capacity and vulnerable groups at risk and those with a potential risk of exposure to hazardous waste; environmentally sensitive areas to hazardous waste emissions, hot spots and contaminated sites was reported on.

No institution or organization has been mandated to monitor hazardous waste in the environment, food, feed and humans, though some organizations may deal with some aspect of this, especially in analysis, in the course of their work. No institution monitors the presence of POPs Pesticides, industrial POPs, dioxins and furans.

The use of Personal Protection Equipment is very limited among agricultural workers. This may either be due to lack of knowledge on its significance or sheer recalcitrance. The same can be said for transportation, storage and disposal of chemicals and their containers after use. Medical surveillance among hazardous waste users needs to be researched. Employers should be sensitized to provide routine medical examinations for their employees. In areas of dioxin and furan releases, vulnerable groups are taking no special precautions. There is therefore an urgent need for sensitization at both the individual and institutional levels if preventive measures are to be effective.

The gaps identified can be bridged by measures put in place to increase public education and raise awareness. Encouragement of research in grey areas, training of specialists, conducting of studies on health effects of those exposed and the general public. Priority areas that need urgent attention include the following:

- Training of specialists in clinical toxicology to strengthen poisoning management in health institutions and poison centers;

- A well-equipped national accredited laboratory, which can analyze and detect samples to the minutest detail possible.

For Ghana, the focus should be set on the topics awareness raising, compilation and dissemination of information, improvement of know-how and technical assistance and demonstration or pilot projects. Besides the EPA, the planned Cleaner Production Centre will play a major role in the planning and implementation of the relevant measures.