THE REPUBLIC OF THE SUDAN

Ministry of Environment and Physical Development

HIGHER COUNCIL FOR ENVIRONMENT AND NATURAL RESOURCES

SUDAN

NATIONAL IMPLEMENTATION PLAN FOR THE STOCKHOLM CONVENTION ON POPs

2007

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Executive Summary

This document is the National Implementation Plan (NIP) for the management and phase-out of the Persistent Organic Pollutants (POPs) in the Sudan. The NIP is compiled according to Article 7 of the Stockholm Convention on Persistent Organic Pollutants (POPs). Sudan has ratified the Stockholm Convention in 2006 and is thus committed to manage and phase-out the POPs as stipulated in the Convention.

The main POPs substances are nine pesticides (Aldrin, Chlordane, Dieldrin, Endrin, Heptachlor, Hexechlorobenzene (HCB), Mirex, Toxaphene and DDT), polychlorinated biphenyls (PCBs), unintentionally produced polychlorinated dibenzo-p-dioxins and dibenzofurans. Scientific studies indicate that POPs chemicals are toxic. These chemicals have a tendency to accumulate in fatty tissues and due to their persistence they are biomagnified in the bodies of animals at higher trophic levels and thus end up in humans through the food chain.

In this exercise the NIP was developed in 2004 – 2006 in a process funded by GEF and supported by UNDP by national, international experts and a large number of Sudanese stakeholders involved in different aspects of POPs,. The agency guiding the NIP development has been the Higher Council for Environment and Natural Resources (HCENR) of the Ministry of Environment and Physical Development. The stakeholders' interests and views were involved through the Multi-Stakeholder National Coordination Committee (MNCC) that convened around 10 meetings during this plan development process.

The NIP describes the background of the POPs issue in Sudan, the current situation of POPs substances and estimated emissions into environmental media, estimated impacts and how Sudan will meet its obligations under the Stockholm Convention.

Sudan's current population is approximately 35 million, two third of which is rural. The Recent population growth figure is approximately 2.5 % per annum with increasing share of urban population. People under five (5) years of age make approximately 15% of the total population. Agriculture counts for some 37 % of the GDP but provides livelihood for 70 % of the population. Literacy rate for both sexes (above 15) is approximately 50%. A remarkable factor is the rapidly expanding oil and petroleum sector, which accounts for more than 80 % of exports and 40 % of public revenue.

Sudan has never produced any POP chemicals. A commercial plant to formulate pesticides from imported active ingredients was operational from nearly 1960 to 1991. Sudan has not imported or exported any POP chemicals since the year 1998 when DDT was last used for malaria control.

According to the surveys carried out in 2004 - 2005 the quantity of obsolete POPs pesticide stocks is 234 tons spread over some 340 storage sites throughout the country. Most of the obsolete stocks are in Northern Darfur, Kassala, Nahr Alnil and Gezira States. A large number of storage sites are in need of maintenance and better management. In addition to pesticide substances some 527 tons of

contaminated pesticide containers (drums) were identified. The quantity of contaminated soil is estimated at 8,850 tons. Moreover there are about 400 tons of left-over seeds dressed with POP pesticides. There are very few specific studies on the impact of POP pesticides on humans, and the different ecosystems in Sudan. The preliminarily studies indicate that people living in the vicinity of the agricultural areas may have higher concentrations of some POP chemicals in their blood and tissues.

Polychlorinated biphenyls (PCBs) are used as dielectric liquid in electric transformers and condensers. Practically all transformers in Sudan belong to the National Electricity Corporation (NEC), which is responsible for the generation, transmission and distribution of electricity in the whole country. The total number of electric transformers in Sudan is estimated, in the survey made in 2004-2005, at 15000 units. The total weight of these units is approximately 68,700 tons, out of which 18,000 tons are dielectric liquid and 50,700 tons present the dry weight. The quantity of PCB in liquid phase stored at NEC's premises is estimated at eight tons. Although PCBs are used for the maintenance of old transformers yet NEC staff do not have extensive previous knowledge about their adverse impact.

DDT has not been used for agricultural purposes since the beginning of 1981. After that till 1998, DDT was used for malaria and vector control at an annual quantity not exceeding 100 tons in average. At present there is no DDT stock in Sudan.

The releases of the unintentionally produced POPs, i.e. dioxins and furans are estimated at 991.7 g TEQ (Toxic Equivalents) per annum. The main source of the release is the uncontrolled combustion (94 % of the total) consisting mainly of uncontrolled burning of domestic waste, which makes 802, 5 g TEQ, (91 % of the total releases). Other essential release sources are power generation and heating (2.43 % of the total), production of chemicals and consumer goods (2.42 % of the total) and secondary production of metals (0.68 % of the total). There are no remarkable hot spots but certain industrial processes and burning obviously present occupational risks. Urban population and especially people living at the outskirts of the urban areas are exposed to the release from waste burning.

The current regulatory frameworks don't specifically address the POPs. The Environment Protection Act, The Environmental Health Act as well as certain labour protection regulations address risks similar to the risks of POPs but start to be a bit obsolete and do not go to a point matching the current level of knowledge. In general Sudan lacks the analytical capacity to study the impact of some POPs both in the ecosystem components as well as in humans.

Sudan is committed to manage and phase-out the POP chemicals as stipulated in the Stockholm Convention. The regulatory framework is continuously updated. Further, Sudan aims at applying the Polluter Pays Principle (PPP) to mobilise the economic and financial incentives in tackling the POP emissions. In the overall strategy to reach the objectives and phase-out POPs according to deadlines, Sudan has proposed a combination of measures including Government's involvement (regulation reforms and law enforcement efforts), supportive local actions, market instruments like subventions and tax-breaks and extensive international cooperation including co-funding.

Sudan has set national priorities regarding the implementation of the POP management and phase-out actions. Tackling the stocks of the obsolete POP pesticides, the contaminated containers and the contaminated soil around the pesticide stores is considered a first priority. The second priority is to tackle the uncontrolled waste burning and all the subsequent waste management activities to reduce the dioxin and furan emissions in the densely populated areas. The third priority of POPs management and mitigation actions

is to reduce and eliminate the risks related to the PCB containing electrical equipment. DDT use for malaria and vector control is to be prevented through extensive regional cooperation with WHO.

Proposed actions to manage the POPs issues consist of one institutional project at the Higher Council for Environment and Natural Resources. This project proposal is based on the very encouraging experiences gained from this NIP development process. This project is planned for a period of five years at a cost of 300,000 USD.

Further actions consist of four specific pesticide related projects, nine PCB related projects and ten dioxins and furans related projects. The elimination of the need to use DDT in malaria and other disease vector control is handled in four action plans (four project profiles).

The proposed management and phase-out projects for POP pesticide are as follows:

1. Amendment of the existing legal instruments and strengthening law enforcement. Cost 60,000 USD.
2. Strengthening the capacity to handle POP pesticides, containers and contaminated soil, Cost 1,590,000 USD.
3. Raising awareness of POP pesticides with particular reference to related waste and contaminated sites. Cost 1,575,000 USD.
4. Undertaking ecologically sound measures to eliminate obsolete POP stock and contaminated soil. Cost 1,728,000 USD.

The total cost of the proposed POP pesticide related actions is 4,953,000 USD

The management and phase-out of PCBs will at large take place within the operational framework of the National Electricity Corporation (NEC). The proposed PCBs related management and phase-out activities are as follows:

1. Develop legal instruments and/or technical guidelines for managing PCBs release). Cost 100,000 USD.

2. Comprehensive inventory of PCBs equipment and accessories/articles. Cost 250,000 USD.
3. Training for environmentally sound management of the in-use equipment. Cost 250,000 USD.
4. Socio-economic assessment for the environmentally sound management of the in-use electrical equipment. Cost 200,000.
5. Environmentally sound management compliance of the in-use electrical equipment. Cost 300,000 USD.
6. Strengthening of the laboratory capacity for PCBs analysis. Cost 200,000 USD.
7. Environmentally sound management of the out-of-use electrical equipment. Cost 50,000 USD.
8. Capacity building and awareness raising. Cost 40,000 USD.
9. PCBs database establishment and management. Cost 180,000 USD.

The total cost of the proposed PCBs related actions is 1,570,000 USD

The management and phase-out of dioxin and furans releases consists of several policies, legal framework and awareness raising actions as well as of concrete activities to affect the release sources as follows:

1.	**Policy and legal framework for the management of UPOP**	**Cost 100,000 USD**
2.	**Capacity building and technical support.**	**Cost 500,000 USD**
3.	**Municipal waste management.**	**Cost 275,000 USD**
4.	**Residential Combustion.**	**Cost 450,000 USD**
5.	**Metallurgical thermal processes.**	**Cost 170,000 USD**
6.	**Awareness raising and technical networking.**	**Cost 500,000 USD**
7.	**Hazardous waste co-incineration.**	**Cost 200,000 USD**
8.	**Textile and leather dying and finishing.**	**Cost 100,000 USD**
9.	**Inventory and database of unintentionally produced POP.**	**Cost 110,000 USD**
10.	**Medical wastes treatment.**	**Cost 225,000 USD**
The total cost of proposed UPOPS related actions is		**2,630,000 USD**

DDT action plan and total cost:

1. Country needs assessment	091,000$
2. Institutional research networks	500,000$
3. Monitoring and evaluation of DDT alternative	200,000$
4. Public awareness and community participation	750,000$
The total cost of proposed DDT related actions is	**1,541,000$**

The timing of the actions and technical interventions is thought to fall mainly in the period of 2006 – 2010. The POP pesticide issue in particular, needs to be addressed soonest possible. Activities addressing dioxins and furans releases, especially those regarding the uncontrolled burning of waste and municipal waste treatment deserve most urgent attention.

The total cost of allthe proposed actions is 10,994,000 USD.

Out of that amount most presents incremental costs, but a minor part of the industry related actions may fall outside of the incremental cost concept, since the actions might be regarded as normal investment, with short pay-back periods. Sudan expects that most of the proposed external funding will be available from the Global Environment Facility and UN related sources, but is actively seeking other sources of co-finance like international NGOs, private companies and donations.

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SUMMARY

Abbreviations used in the text:

ARTC	Agricultural Research and Technology Corporation
BAT	Best Available Technology
BEP	Best Environmental Practices
CFCs	Chlorofluorocarbons
COP	Conference of Parties
CPA	The Comprehensive Peace Agreement
CPL	Central Petroleum Laboratories
DLCO-EA	Desert Locust Control Organization for Eastern Africa
DVC	Disease Vector Control
EAF	Electric Arc Furnace
EMRO	Eastern Mediterranean Region of WHO
ESM	Environmentally Sound Management
FFS	Farmer Field School
GEF	Global Environmental Facility
GDP	Gross Domestic Product
GOSS	Government of Southern Sudan
HCB	Hexachlorobenzene
HCENR	Higher Council for Environment and Natural Resources
IPM	Integrated Pest Management
IRS	Indoor Residual Spraying
ISC	Inter-sectorial Steering Committee
ITNs	Insecticide Treated Bed Netes
IVM	Integrated Vector Management
LPG	Liquefied Petroleum Gas
MOAF	Ministry of Agriculture and Forestry

MOAR	Ministry of Animal Resources
MOE	Ministry of Education
MOEPD	Ministry of Environment and Physical Development
MOH	Ministry of Health
MOEM	Ministry of Energy and Mining
MOI	Ministry of Industry
MNCC	Multi-stakeholder National Coordination Committee
NEC	National Electricity Corporation
NIP	National Implementation Plan
NMA	National Malaria Administration
NPC	National Pesticide Council
NPEM	National Plan for Environmental Management
NTEAP	Nile Trans-boundary Environment Action Project
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzo-p-dioxins (Dioxins)
PCDF	Polychlorinated dibenzofurans (Furans)
PDC	Pests and Diseases Committee
PIC	Prior Informed Consent
POP	Persistent Organic Pollutant
PPD	Plant Protection Diroctorate
PPP	Polluter Pays Principle
PVC	Polyvinyl chloride
SAGA	Sudanese Agrochemical Association
SC	Stockholm Convention
SECS	Sudanese Environment Conservation Society
TEQ	Toxic Equivalents
UPOP	Unintentionally Produced POP
VCNA	Victor Control Need Assessment

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1. INTRODUCTION

1.1. THE OBJECTIVE OF THE NATIONAL IMPLEMENTATION PLAN

The objective of the National Implementation Plan (NIP) is to create sustainable capacity and ownership in Sudan to meet the country's obligations under the Stockholm Convention. The NIP is a mandatory instrument according to article 7 of the Stockholm Convention.

The NIP describes how Sudan will meet its obligations under the Stockholm Convention to manage and phase-out Persistent Organic Pollutants (POPs) sources and to manage POPs-contaminated sites in an environmentally sound mannerfacilitating dialogue, information exchange and co-operation between relevant stakeholders – including the governmental, non-governmental, academic and private sectors. The NIP will ensure that POPs are well taken into account in strategy formulations for different economic and technical sectors.

Sudan signed the Stockholm Convention on the 23rd of May 2001, and further ratified it in 2006. Therefore the Government of Sudan was eligible for assistance in the form of an enabling activity project to create sustainable capacity, including preparation and updating of a POP National Implementation Plan (NIP), to meet the country's obligations under the Convention. Further, Sudan has ratified in 2006 the Basel convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (Basel Convention) and the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC),

This National Implementation Plan on the POPs management and phase-out, together with the ratification of the abovementioned two supporting conventions will gear Sudan very well into the international community in the POPs management and will further enable Sudan to participate in the technical cooperation, information exchange and dissemination.

1.2. STOCKHOLM CONVENTION

The adoption of the Convention and its subsequent signing at the conference of plenipotentiaries in Stockholm in 2001 by 92 parties has signalled the end of negotiations that started in June 1998. These negotiations were called for in 1997 by the Governing Council of UNEP in recognition of the need for urgent global action to protect human health and the environment from POPs.

The Convention seeks the elimination or restriction of production and use of all intentionally produced POPs (i.e., industrial chemicals and pesticides). Initially, the chemicals stated for elimination are aldrin, chlordane, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex, toxaphene and polychlorinated biphenyls (PCBs). Continued use of DDT is allowed for vector control until safe, affordable and effective alternatives are in place. Countries must make determined efforts to identify, label and remove PCB-containing equipment from use by 2025, and manage those wastes in an environmentally sound manner not later than 2028. The Convention also seeks the continuous minimization, and where feasible, ultimate elimination of the releases of unintentionally produced POPs such as dioxins and furans. Stockpiles and wastes containing POPs must be managed and disposed of in an efficiently and environmentally safe manner, taking into account international rules, standards and guidelines. Each party is required to develop a plan for implementing its obligations under the Convention.

The Convention also imposes certain trade restrictions, and has a procedure for adding other POPs Governments have set up an interim financial mechanism, with the Global Environment Facility (GEF) as the principal entity, to assist developing countries and countries with economies in transition in their implementation of the Convention.

Article 7 of the Stockholm Convention covers the implementation plans. According to this article,

1. Each party shall:

(a) Develop and endeavour to implement a plan for the implementation of its obligations under this Convention;

(b) Transmit its implementation plan to the Conference of Parties within two years of the date on which this Convention enters into force for it; and

(c) Review and update, as appropriate, its implementation plan on a periodic basis and in a manner to be specified by a decision of the Conference of the Parties.

2. The Parties shall, where appropriate, cooperate directly or through global, regional and sub-regional organizations, and consult their national stakeholders, including women's groups and groups involved in the health of children, in order to facilitate the development, implementation and updating of their implementation plans.

3. The Parties shall endeavour to utilize and, where necessary, establish the means to integrate national implementation plans for persistent organic pollutants in their sustainable development strategies where appropriate.

The Government of Sudan has clearly noted the stipulations of the Stockholm Convention and especially those governing the implementation plan, called National Implementation Plan, (NIP). Further, the several guideline documents, compiled by UNDP, UNEP, UNIDO and World Bank have been consulted to make clear the requirements and formalities governing the NIP content and extent.

1.3. The NIP COMPILATION PROCESS IN SUDAN

The development of the National Implementation Plan (NIP) to manage and phase-out persistent organic pollutants was initiated in early 2004 by nominating the Higher Council for Environment and Natural Resources (HCENR) as the responsible implementing agency within the Government. UNDP has been the executing agency. The main funding source has been the Global Environment Facility, (GEF).

The practical work started in mid-2004 by assessing the current capacity, establishing a specific office at HCENR, appointing project director and assistants and compiling a draft work plan. The UNDP country office in Khartoum was of vital importance in initiating the work. A steering committee, called Multi-stakeholder National

Coordination Committee (MNCC) representing 22 different governmental authorities, businesses and NGOs was formed as follows :

	Stakeholder
1.	United Nations Development Programme (UNDP)
2.	Higher Council for Environment and Natural Resources (HCENR), Ministry of Environment and Physical Development
3.	Ministry of International Cooperation
4.	Ministry of Foreign Affairs
5.	Ministry of Justice
6.	Department of Customs, Ministry of Interior
7.	Ministry of Agriculture and Forestry (Irrigated Sector)
8.	Plant Protection Directorate, Ministry of Agriculture and Forestry
9.	National Pesticide Council
10.	Ministry of Health (Environmental Health and Food Control Administration),
11.	National Chemical Laboratories, Ministry of Health
12.	Ministry of Industry
13.	Prior Informed Consent (P.I.C) Focal Point
14.	Sudanese Chambers of Industries Association (representing private businesses)
15.	Khartoum State Public Health Corporation
16.	Sudanese Environment Conservation Society (NGO)
17.	Agriculture Research and Technology Corporation, Ministry of Science and Technology
18.	Ministry of Energy and Mining
19.	National Research Center, Ministry of Science and Technology
20.	National Electricity Corporation, Ministry of Energy
21.	National Malaria Administration, Ministry of Health
22.	Sudanese Agro-chemical Association (SAGA) (representing private sector pesticide industries/businesses)

The MNCC has had 10 plenary sessions during the NIP compilation process. In addition to the plenary sessions the MNCC has formed several temporary working groups (composition / membership varying according to the subject matter; e.g. occupational health (participated in matters related to workers health), women association (for matters related to women and children), Ministry of

finance (for financial aspects), NGOs for their role in advocacy and awareness raising).

POPs pesticide inventory (Annex A, Part I substances) was supported by a team of 21 technical staff and the compilation of the management , phase-out strategy, and action plan were monitored and developed by an expert group of eleven representing the key stakeholders.

The PCB related activities were largely run within the National Electricity Corporation (NEC) which is the sole generator, transmitter and distributor of electric energy in Sudan. The NEC formed internal groups covering the inventory, assessment and action plans. Sixteen electrical engineers directly participated in the inventory process in the field, assisted by support staff. Ministry of Energy participated in the activities, especially when dealing with the strategy and actions plans. It should be noted that the NEC contributed not only in kind, by providing survey teams and experts, but also in cash for the survey related travel and other field work costs in various parts of the country.

The malaria related (possible) DDT use and the strategy were elaborated by a working group of 15 experts.

The activities related to the inventory and assessment of the unintentional production of POPs (Annex C source categories, dioxins and furans) were conducted and monitored by an expert group of 15. The compilation of the management and phase-out strategy and action plan was monitored by an expert group of 10.

All the working groups mentioned above initiated their work by receiving training and guidance by external experts, who highlighted the key issues to be tackled. Furthermore, these working groups have acquired a comprehensive knowledge about the whole POPs issue and thus their support to the Stockholm Convention implementation and related activities later on is most ubiquitous.

All in all more than one hundred people, representing the relevant stakeholders and their staff, participated in the process. Annex (2) of this report shows the names of the people who were involved in the NIP compilation process.

Furthermore, HCENR wishes to acknowledge the contribution of the private industries, business and NGOs who supported this work with technical data, plans and information.

This exercise makes a good asset for the forthcoming awareness raising and information dissemination regarding the management and phase-out of POPs as well as mitigating their adverse impact.

DEVELOPMENT OF THE NATIONAL IMPLEMENTATION PLAN[1]

Activity	2004				2005				2006			
A. Establish and operate enabling activity project co-ordination mechanisms	Establishment and staffing of POPs unit at HCENR											
		HCENR & MNCC mandate period										
B. Strengthen capacities for effective project implementation			Continuous operation of POPs unit at HCENR, national and international experts' input									
C. Conduct baseline assessments of national infrastructure and capacities and socio-economic impact of POPs exposure							Socio-economic*) assessment and MNCC workshop					
				Assessment of POPS monitoring and research capacity								
				Human and ecological impact of POPs								
					Assessment of legislative and institutional frame							
D. Prepare initial POPs inventories					Pesticides, stockpiles, contaminated soils ,DDT, Dioxin/Furan, sources PCB*)							
E. Set objectives and priorities for POPs and POPs reduction and elimination options							Elaboration of priorities, *) MNCC **)workshop					
									Consultation with stakeholders, NIP draft MNCC workshop			
F. Prepare draft National Implementation Plan (NIP) for meeting Sudan's obligations under the Stockholm Convention												
									NIP REPORT			
G. Review and finalize NIP												

*) The activities were carried out with the support of international experts

[1]) The sequence of activities refers to the Project Document "United Nations Development Programme - Global Environment Facility POPs Enabling Activity Proposal: Sudan - Enabling Activity: Initial assistance to Sudan to meet its obligations under the Stockholm Convention on Persistent Organic Pollutants (POPs)"

The specific inputs, duly reported, in the process are as follows:

1. Initial capacity assessment, identification of national and international experts, detailed work plan, in June-August 2004 by the project director and international consultant.
2. Pilot inventory (guided methodology wise by an international expert) and initial inventory (covering the whole country) of pesticides stocks, stores and contaminated soils: Initiated in late 2004, revised in 2005-2006 by national experts.
3. Review of the sources of the dioxin and furans (unintentional POPs) releases. Initiated in 2004 revised in 2005 by national experts supported methodology wise by an international consultant. Training of two people in Germany
4. Report on BAT/BEP considerations for reduction of unintentionally formed Persistent Organic Pollutants (UPOPs) releases in Sudan, by an international consultant, 2005.
5. Review of the DDT use in vector control, by national expert, from the Malaria Administration, 2004.
6. Inventory (sample based) of the PCBs containing equipment in the operational areas of the National Electricity Corporation, Initiated in 2005 and further elaborated in 2006.
7. Assessment of the socio-economic impact of POPs prepared by an international reviewed by the MNCC in 2005.
8. Setting of national priorities, reported in 2005 reviewed by the MNCC and the international expert.
9. Report on The National Legislative and Institutional Framework: An Evaluation in Light of the Stockholm Convention, 2005.
10. Assessment of National POPs Monitoring, Research and Development capacity for POPs in Sudan, 2005.
11. Report on the awareness raising programmes, 2006.
12. Report on the Level of POPs chemicals in the Environment and Humans, 2006.
13. Fourth WHO-coordinated Survey of Human Milk for Persistent Organic Pollutants, 2006.
14. Training workshop on action plan development, supported by UNITAR, held May 2005.

Specific consultation meetings about the DDT use in the malaria / vector control was heldin April 2006, attended by all the relevant stakeholders. The DDT strategy presented in this NIP is based on these consultations.

Since the start of the enabling activity and the compilation of the National Implementation Plan the POPs issues has received publicity in the media (newspapers, radio and TV). Several NGOs have raised the POPs issue in their community based activities.

2. COUNTRY BASELINE

2.1. THE PROFILE OF SUDAN

2.1.1. GEOGRAPHY AND POPULATION

Sudan is located in the north eastern part of Africa, being the largest country in the continent with a total area of 2,505,810 km^2 (967,500 sq. miles) making 8.5% of Africa and 1.7% of the world lands. Its geography ranges from desert in the North to grasslands in the centre and tropical bush in the South. The Blue and The White Niles joins in Khartoum to form the main River Nile. Sudan extends from latitude 4 to 23 degrees north. Sudan is neighbouring nine countries Egypt, Libya, Chad, Central African Republic, Zaire, Uganda, Kenya, Ethiopia, and Eritrea, Sudan is of twenty five states. Based on the last census (2001) the country population was estimated at 34.51 million of which 29.1 million were in the northern states (84 %) with growth rate of 2.83% and 1.6% in the north and south respectively.

For practical purposes, regarding implementation of this plan, the huge size of the country (equals Western Europe or European Union) has to be noted. The distance in north – south direction is more than 2000 km and in west – east is 1500 km. Transportation infrastructure covers well the central and north-western parts of the country while the western and southern parts still depend on communications occasionally difficult to use. To reach the main port (Portsudan) from Khartoum or from the main agricultural areas in the Gezira, it takes one day or more by road. Generally all the geographic characteristics make all the logistics expensive, and this is reflected in the profiles of the proposed projects.

Table (1) highlights the population distribution and the characteristics, which are relevant in assessing the impact of POP pesticides and their adverse impacts effects. Biomass burning and the subsequent unintentional production of harmful dioxins and furans is largely a rural issue while the dioxin and furans from waste burning and other waste management related operations as well as industrial sources mainly concern the urban population. Young children and their mothers are especially expected to be exposed to the harmful impacts of POPs.

TABLE 1.1 Population Structure of Sudan[2]

Area	Estimated population		Annual growth % 2003-08	Rural population % of total	Urban population. % of total	Pop under 5 years old	
	number	%				number	%
1. Northern	624,000	1.8	1.58	83.94	16.06	89,000	14.20
2. Nahr Alnil	972,000	2.8	1.81	64.58	35.42	141,000	14.48
3. Red Sea	734,000	2.1	0.30	37.54	62.46	89,000	12.07
4. Kassala	1,625,000	4.7	2.51	63.86	36.14	253,000	15.58
5. Algedarif	1,674,000	4.9	3.19	69.71	30.29	270,000	16.14
6. Khartoum	5,553,000	16.1	3.67	12.8	87.20	798,000	14.37
7. Algezira	3,797,000	11.0	2.79	76.47	23.53	603,000	15.88
8. Sinnar	1,301,00	3.8	2.53	70.33	29.67	211,000	16.20
9. White Nile	1,636,000	4.7	2.47	69.28	30.72	269,000	16.47
10. Blue Nile	716,000	2.1	2.92	73.12	26.88	110,000	15.38
11. North Kordofan	1,578,000	4.6	1.52	66.11	33.89	262,000	16.58
12. West Kordofan	1,203,000	3.5	1.33	76.96	23.04	198,000	16.50
13. South Kordofan	1,174,000	3.4	1.38	74.56	25.44	191,000	16.30
14. North Darfur	1,655,000	4.8	3.16	79.62	20.38	281,000	16.99
15. West Darfur	1,734,000	5.0	2.37	86.36	13.64	277,000	16.00
16. South Darfur	3,171,000	9.2	3.41	77.98	22.02	507,000	16.00
TOTAL NORTHERN STATES	29,147,000	84.5	2.72	60.84	39.16	4,582,000	15.72
17. Upper Nile	1,506,000	4.4	0.79	72.94	27.06	231,000	15.35
18. Bahr E-Ghazal	2,550,000	7.4	2.31	84.02	15.98	398,000	15.59
19. Equatoria	1,310,000	3.8	0.75	72.13	27.87	185,000	14.09
TOTAL SOUTHERN STATES	5,366,000	15.5	1.51	75.2	24.80	813,000	15.16
TOTAL SUDAN	34,513,000	100	2.53	63.82	36.18	5,394,000	15.63

[٢])Source: UNFPA, 2005. Due to the lack of recent census data and the recent administrative delineations the population of the ten (10) Southern states is presented three (former) entities only.

2.1.2. ECONOMIC AND POLITICAL PROFILES

Sudan is well endowed with natural resources in terms of agricultural potential and minerals. The economy is and, for the foreseeable future will remain highly dependent on agriculture and oil. Agriculture is the mainstay of the economy, contributing about 37% of GDP, 15% of exports is providing the livelihood for about 70% of the population. The agricultural contribution to GDP has declined during the last five years, while the oil sector has developed from almost nil to more than 11% of GDP over the same period.

Oil and petroleum products now account for 81% of exports and 40% of public revenue. The oil sector developed very rapidly between 1998 and 2000 and since then growth has been steady but moderate. Oil production has changed some of the fundamental parameters of the economy, which now show a commodity trade surplus, though subject to large price fluctuations in the volatile oil market.

In spite of the potential for national food self-sufficiency, importation of foodstuff remains high (20% of total imports), whereas self-sufficiency in petroleum products is close to being achieved, having dropped from 22% to 7% of imports during the past five years. However, neither the potential of the agricultural sector, nor that of the oil sector, are being fully exploited. While both are prone to frequent external shocks from climatic conditions and/or international price fluctuations, major constraints to developing their potential originate directly or indirectly from the settlement of the internal conflicts. Sudan will benefit from the European Union’s trade policy initiative, especially from 2006, when liberalization of the EC sugar market set in. Public management of the agriculture sector is another major concern. Recent years have witnessed active government policy supporting expansion of the industrial sector, which currently contributes 9% of GDP and is primarily agro-processing industry and oil refining. The sugar industry is expanding, and the textile production has a substantial potential. Major investments have been made in oil refining with plans for further expansion. However, a more diversified industry based on oil could develop (fertilizers, plastics etc.) given an environment conducive to commercial investment, including access to the entire local market potential.

Since 1997 Sudan has successfully implemented a comprehensive macro-economic programme monitored by the IMF. Due to development of the oil sector, the economy has shown annual real rates of growth in the order of 5-8%. Reduction of inflation to single digit levels, a stable exchange rate with free convertibility, reduced direct corporate taxation and privatization of state enterprises. The Investment Encouragement Act, revised in 1999, gives substantial incentives to new investments and treating local and foreign investment equally, are all measures that should improve the environment for commercial investment. Major constraints to growth remain, however the most important. These include the unstable and insecure environment for utilisation of natural resources, run-down economic infrastructure, limited investment finance and a poorly skilled work force. Moreover there are constraints on technology transfer through foreign direct investment.

The Government has given priority to expansion of the electricity supply, which is being doubled by means of two thermal power plants under construction in the vicinity of Khartoum (financed by China and Malaysia). A further doubling of capacity is planned through the proposed Merawe Dam project in the North, for which funding is still being sought in addition to the USD 500 million already secured from four Arab funds.

The road network is, for the most part, in poor condition. Most paved roads are concentrated in the centre and north-east of the country. Many of these trunk roads suffer from irregular maintenance. The bulk of upgrading and new construction of trunk roads is limited to the same area. The Government is introducing private investment in power generation and trunk road construction through build-operate-transfer systems. The road network being maintained at state and locality level is extremely limited. Outside urban centres roads are exclusively of gravel with little or no maintenance.

Development of the work force is one of the key issues. The development of the vocational training and technical skills are essential. The current schooling and training capacity is insufficient, especially when noting the quickly expanding industry. At higher education levels, the skills of the labour force are a bit out of balance regarding market demands and affected by a significant brain drain to Middle East countries.

The political and administrative structure involves that legislative power is exercised at the national level while the executive powers are large vested in the state administrations. Due to the large size of the country it is obvious that the administrative divisions are not necessarily fixed for the long period but geographical borders changes etc. might take place. Due to the recent political development states and larger regions, especially the Southern part of the country may have more autonomy in implementing the environmental and related legislation.

Administratively the country is divided into 25 states (wilayah). (Plate 1).

Plate 1. Sudan Map Showing the different States

ENVIRONMENTAL OVERVIEW

The overall status of the environment in Sudan should be reviewed against the huge size of the country with conditions ranging from arid deserts in North and North-West to the tropical rain forests in the South.

The country has experienced environmental degradation during the last 20-30 years. The main causes of environmental degradation, as rated by the UN, are low rainfall (38%), over-cutting (32%), over-cultivation (15%) and over-grazing (13%). All but the first is directly or indirectly related to the country's internal development, which has recently involved massive displacements of population and movement. Oil sector development poses additional threats to the environment but present also a huge opportunity to finance environmental programmes for improvements.

Urbanization is rapidly continuing, which has resulted in poor housing conditions with the related environmental problems in the outskirts of Greater Khartoum area and in other urban districts.

The environmental issue in Sudan, at large, is concentrating around the sustainable use of the natural resources. The environmental problems caused by urbanization, industrialization and e.g. transportation are seen, but they still present a rather modest problem compared with several other countries in the region.

In general, public and government awareness on environmental issues has increased in the past years, enhanced. e.g. by the Environmental Protection Act 2001. The major international environment related agreements and conventions are well received in Sudan and are being monitored, reported and implemented by the Government as well as by the NGOs. The key developments are highlighted as follows.

The **Higher Council for Environment and Natural Resources** was created in 1991 with the following objectives:

- Setting policies related to natural resources;
- Protecting the environment in cooperation with other centralized and decentralized authorities;

- Long term planning for the best utilization of natural resources;
- Reviewing laws governing the use and protection of natural resources;
- Encouraging research in all areas connected with environment and natural resources; and
- Planning a permanent development strategy, compatible with Agenda 21.

The **legal and institutional framework** supporting sustainable development includes the Ministry of Environment and Physical Development, National Council for Aquatic Resources, National Council for Pesticides, Committee for Drugs registration, Administration for Combating Desertification.

Sudan signed the Convention on Biological Diversity and has established a Bank of Hereditary Sources for the collection of information and records on biodiversity preservation. Sudan has developed and will seek funding for biological diversity projects relating to the Red Sea (a regional effort) and preserving the hereditary sources of domestic animals.

Chief among the projects developed by Sudan is the Meteorological Observation project, for which Sudan is actively seeking funding. A project evaluating national capabilities for implementing the **Convention on Climate Change** has already received funding from the UN Development Programme (UNDP).

Sudan established a **National Administration for Combating Desertification and Drought** in 1979 and has carried out numerous activities related to desertification. Sudan has ratified the Convention and, as obliged by it, has prepared a national program to combat desertification (a collaborative effort between government and non-governmental voluntary organizations). Sudan has developed a five-year program to combat desertification and has identified the hardest hit areas. Sudan has also collaborated with the Arab League organization on a regional approach to combat desertification in Bara area.

Furthermore, the agricultural schemes must, by law, allocate percentage of an area (10% in the rain-fed and 5% in the irrigated

agriculture) to be allocated for forest. This obligation is backed by a provision under the Forests and Natural Resources Act 2002.

Sudan has ratified the **Vienna Convention and the subsequent Montreal Protocol** on ozone depleting substances and has banned CFCs in coolants and aerosols and has initiated programs to manage and phase out all ozone depleting substances.

Furthermore Sudan has ratified the Stockholm Convention, Basel Convention, Rotterdam Convention and the Bamako Convention, which is a regional (African) application of the Basel Convention.

All the above mentioned conventions/commitments put Sudan firmly on the international community to protect the environment. The implementation of the conventions is reflected by the established and well functioning environmental administrations.

2.2. INSTITUTIONAL, POLITICAL AND LEGISLATIVE FRAMEWORK

2.2.1. ENVIRONMENTAL, SUSTAINABLE DEVELOPMENT POLICY AND GENERAL LEGISLATION FRAMEWORK

The Constitution of the Republic of the Sudan 1998 provides that “the State shall promote public health, encourage sports and protect the environment, in its purity and natural balance, in pursuance of safety and sustainable development for the benefit of generations.” Regarding the natural resources, article (9) of the Constitution stipulates, “natural resources under or on the surface of the earth and in the territorial waters are public property regulated by law; and the State shall provide plans and appropriate conditions for the development of the financial and human resources necessary for utilizing such wealth.” With regard to social justice, article (11) provides “the State shall give due regard to social justice and mutual aid in order to build the basic components of the society, to provide the highest standard of good living for every citizen, and to distribute national income in a just manner to prevent serious disparity in incomes, civil strife, exploitation of the enfeebled, and shall care for the aged and disabled”.

The abovementioned statements in the Constitution did not make any definite set of rules controlled by constitutional adjudication; however, they are principles that the executive organ is guided by in

its projects and are observed by the legislative organs in law making, recommendations and control measures, and to which, all who are in the service of the State should aspire. Apparently, lack of adequate financial resources and technical capabilities are among the main factors for the law maker to resort to this sort of approach in order to absolve itself from possible legal accountability that may arise for failures to secure the basic human and environmental rights enshrined in the above cited provisions or any other relevant enactment.

The Comprehensive Peace Agreement (CPA) which brought the long civil war between south and north to an end should be perceived as a sign of optimism that will hopefully create the favourable political, economic and legal climate that is needed for the effective implementation of environmental policies and legislations. Pursuant to Article 226(5) of the Interim National Constitution, all current laws that have not been abrogated are declared to remain in force, unless new actions are taken in accordance with the provisions of the Interim Constitution. Apart from the above, the Interim National Constitution has embodied numerous provisions with direct bearing on environment and human health. For example, Article 11(1) provides that the people of the Sudan shall have the right to a clean and diverse environment. The same Article goes on to state that the State and the citizens shall have the duty to preserve and promote the country's biodiversity. Furthermore, Article 11(2) prevents the State from pursuing any policy or taking any action, which adversely affects the existence of any species of animal or plant or their natural habitats.

In addition to constitutional directives, the country has promulgated the Environmental Protection Act in 2000 with the following main objectives:

- Protection of the environment in its holistic definition for the realization of sustainable development;
- Improvement of the environment and the sustainable exploitation of natural resources;
- Creation of a linkage between environment and development issues, and the empowerment of concerned national authorities and organs to assume effective role in environmental protection.

The Higher Council for Environment and Natural Resources has been established in 1992 but has gained its full legality by virtue of section 5 of the environment protection act. The main office of the Council is located in Khartoum. According to section (6) of the Act, the Council is presided by the Federal Minister of Environment and Physical Development and its membership is drawn from the relevant Ministries.

The Comprehensive Peace Agreement (CPA) has not only ended Africa's longest civil war, but has also ushered in new opportunities for national reconciliation, healing, reconstruction and development. In this context, the Higher Council for Environment and Natural Recourses (HCENR) in cooperation with the federal line ministries and Ministry of Environment, Wild life Conservation and Tourism of the GOSS, is preparing a National Plan for Environmental Management (NPEM). The plan is sponsored by the Nile Trans-boundary Environment Action Project (NTEAP), United Nations Environment Program (UNEP) and the European Commission (EC). The approach is based in bringing institutions concerned with environment and natural recourses together to establish a national forum for highlighting national and regional environmental issues facing Sudan and to encourage technical discussion and public debate on these issues in order to prepare an Environmental Management Plan for post conflict Sudan that illustrate the shared vision of all partners and highlights important and priority actions.

2.2.2. ROLES AND RESPONSIBILITIES OF ORGANISATIONS AND STAKEHOLDERS INVOLVED IN THE POPS LIFECYCLE IN SUDAN

Since the POPs issue is a new one in Sudan, the roles and responsibilities regarding the POPs and their life cycles are not yet very clear. The existing legislation and regulatory framework doesn't address the POPs as such, but governs several aspects, which are related to the POPs.
However, it should be noted that environmental education is geared in the curricula of all schools. The University of Khartoum has established an Institute of Environmental Sciences and other universities have departments specialising in the environmental

issues. Several ministries, e.g. Ministry of Energy , Ministry of Industry, Ministry of Health, have environment departments/directorates with the responsibility to review, analyse and implement environment related issues and activities within their jurisdiction. It is clear that the Persistent Organic Pollutants related matters have been extensively handled within these organisations but naturally the Stockholm Convention and its implementation will bring new structures and strength when these pollutants are handled.

The Higher Council for Environment and Natural Resources, under the Ministry of Environment and Physical Development, is in charge of the environmental policy and related development work in general. Basically the above mentioned Environmental Protection Act of the year 2000 empowers the HCENR to tackle comprehensively the POPs issue, but in practice HCENR can only enhance and monitor the management and phase-out of POPs leaving the operational responsibility for sector authorities.

Regarding the POP pesticides (Annex A, Part I substances, excluding PCB) the Ministry of Agriculture and Forestry and the National Pesticide Council have been instrumental in regulating and supervising the use of these substances. Sudan has never been a primary producer of these substances and the use stopped some 15 to 25 years ago. However, the residues of these substances are still found in the environment. Moreover there are some 233 tons obsolete stocks, 528 tons of contaminated containers, approximately 8850 tons of POP pesticides contaminated soil around the former present storage areas as well approximately 400 tons of dressed seeds contaminated with POPs which are regarded as waste. It is clear that the agricultural authorities who are responsible for the pesticides and their handling are also considered primarily responsible for the obsolete stocks, seed waste, and contaminated containers and soils.

Sudan has not imported most of the POP pesticides since early1990s. The imports of pesticides is clearly regulated by the National Pesticide Council.

Regarding the use of polychlorinated biphenyls, PCBs (Annex A, part I and part II) the only importer has been the National Electricity Corporation (NEC), which is still having PCB in transformers. There

is no legislation governing the PCB as POP. The handling and disposal of used PCB as a chemical substance is managed by the NEC, which applies to its own internal procedures. Some general occupational health governing rules might be applicable when the PCB and PCB contaminated equipment is handled, but these regulations do not necessarily pay attention to the PCB as such but address hazardous chemicals and related risks.

DDT use for agricultural purposes has stopped in 1980 together with some restrictions on other POP pesticides e.g. Toxaphene. Since then DDT has been used only for vector control, but also for that purpose the use stopped in 1998. All DDT use for vector control since then has been strictly controlled by the National Malaria Administration, Ministry of Health and by the National Pesticide Council, which have all the necessary regulatory instruments regarding possible importation, storage, distribution and application of DDT.

Regarding the unintentional production of PCDD/PCDF, HCB and PCB sources the picture is very dispersed when it comes to the roles and responsibilities of the governmental organizations governing them. More than 94 % of all releases are from uncontrolled combustion processes, and within that release category some 86 % of the releases are from the uncontrolled domestic waste burning. It is clear that this source category includes a large variety of bad practices; just getting rid of the waste but obviously also to utilize the energy content of waste for some economic activity. In general the waste burning falls within the domain of the authorities responsible for the public health and for promoting the better practices in waste management. Increasing volumes of domestic waste, however, include goods and commodities, which could be recycled and reused, and thus contributing positively so that the waste accumulation (and disposal, burning) develops at a slower rate than the volume of these goods and commodities. For the time being there is no policy neither regulations nor authorities to support this. The issue of recycling and recovery, is mainly in the hands of some NGOs even though initial signs of the market based recycling activities can be seen. Private vendors are starting to get interested in the waste recycling to utilise the commercially recyclable and profitable fractions of wastes.

More than 10 % of the PCDD/PCDF releases are from the agricultural sector, from forest fires and from burning of agricultural residues. The role of agricultural authorities in tackling these source categories should be vital, but obviously there are no firm policies to be adopted.

Industrial sector accounts for approximately 3 % of the PCDD/PCDF releases. In practice these releases are related to the emissions of particulate matter (flue gas, ash, fly ash and dust), which emissions are not controlled by any regulations. However, the air pollution issue is starting to receive more attention and the authorities have arranged seminars and e.g. some NGOs are raising the issue. However, tackling the industrial sources is much more business - wise and economic issue than a regulatory issue. Most of the releases present uneconomic and low-profit practices and will be phased out with the necessary technology improvements. These improvements, however, need strong support from the authorities responsible for the industrial development (e.g. a system of leaner production) but also from the authorities responsible for occupational health and safety and public/environmental health. The role of industrial associations in promoting good practices (e.g. different certification schemes) will be vital as well as the practices as certain large industrial companies like GIAD complex, Kenana Sugar Factory and large textile processing companies.

Power generation and heating accounts for more than 3 % of the of the PCDD/PCDF releases, of which almost all come from the domestic heating and burning of biomass. It is estimated that between 4-5 million household burn biomass. Such activity covers a large variety of technical solutions from rudimentary arrangements to more sophisticated equipment. No authority or organization is in charge of these practices but the rapidly developing energy sector will provide solutions e.g. through extensive utilization of LPG, kerosene, electric energy and direct utilization of solar energy. The energy business, Ministry of energy as well as financial institutions should be and can be geared to reduction of PCDD/PCDF releases utilizing both regulatory and financial instruments enabling movement towards non-POPs energy sources.

There is no enough research-based information on the releases and transgression of POPs and e.g. the laboratory capacity can cover only a tiny fraction of the information needed. This information is vital

for the development of further regulatory measures. Gearing the health authorities, with the environmental authorities, which have the large state wise and municipality - wise network at their disposal, into close cooperation is vital in managing the POPs issue.

2.2.3 INTERNATIONAL COMMITMENTS AND OBLIGATIONS

Sudan is a party to several environment related conventions and agreements, in addition to the recently ratified Stockholm Convention, Basel Convention and the Rotterdam (PIC) Convention. The following international commitments reflect the cooperation network and opportunities Sudan could utilize when implementing the Stockholm Convention:

- The Vienna Convention for the Protection of the Ozone Layer 1985 and the subsequent Montreal Protocol.
- The United Nations Framework Convention on Climate Change 1992.
- The Bamako Convention on the Ban of the Import into Africa and the Control of Transboundary Movement and Management of Hazardous Wastes within Africa 1991
- Convention on Biological Diversity 1992.
- International Convention to Combat Desertification in Countries Experiencing Serious Drought and/or Desertification Particularly in Africa (UNCCD).

Sudan is actively participating in the regional project for Integrated Vector Management. Strategic Framework for the Eastern Mediterranean Regions, 2004 – 2010. The Regional Office for the Eastern Mediterranean of WHO coordinates this project. The modalities of the DDT use in malaria control are discussed within this cooperation exercise.

2.2.4 CURRENT LEGISLATION AND REGULATIONS ADDRESSING POPs

The Environmental Protection Act of 2000 makes a general framework for the management and phase-out of POPs. The Act doesn't specifically refer to POPs, but it is clear that the POPs (as defined now in the Stockholm Convention) have to be treated as an environmental issue at the first instance. Even though the Act is a framework, for guidance only the section (19) provides directive principles for the protection of the environment. These guiding directives can be summarized in the following:

a. Laying down quality standards for the protection of the environment;
b. Preservation of water sources from pollution;
c. Protection of air, food, soil, the vegetation cover and all these components from pollution and degradation;
d. Preservation of animals and other living beings from extinction induced by illegal hunting or any other threat by human;
e. Protection of food from contamination or pollution generated by chemicals or any other factor;
f. Protection of the air space from pollution caused by physical operations or chemical, and
g. Preservation of the soil from any pollution resulting from harmful industrial and various types of wastes.

POPs related specific legislation can be summarised as follows:

The main national enactment that regulates pesticides is the Pesticides and Pests Control Products act 1994. This Act has repealed the Pesticides Act 1974. However, pursuant to section (2) of the Pesticides Act 1994 and the regulations passed in accordance with the repealed Act continue to be in force, but are subject to any amendment or abrogation in accordance with the enactment in force. The Pesticides Act of 1994 established the National Council for Pesticides with its head office at the Ministry of Agriculture and Forestry. The pesticide council has mandatory members representing 19 organizations, which present most of the interests (also conflicting interests) relevant in managing pesticides substances and their adverse impacts. Even though the POP pesticides are no more in use, the management of old stocks, waste and contaminated soil and equipment are issues that the council cannot avoid dealing with.

The preventive measures stipulated in section 37(1) and (2) of the Road Traffic Act 1983 are also useful, if applied rigorously by the concerned authorities, in eliminating air pollution resulted from automobiles exhaust. However, in the absence of other complimentary trade enactments and regulations that prohibit the importation of, for example, automobiles which do not meet the safety standards, it is unlikely to secure the implementation of these measures. Moreover, in light of the prevailing economic and social

problems facing the country, it is extremely difficult, if not impossible, to implement the type of measures stipulated in the Road Traffic Act 1983. This difficulty shows why most regulations and measures set out by various relevant institutions, for example, the Sudanese Meteorology and Standards Corporation and the Ministry of Foreign Trade, lack adequate enforcement.
The Labour Act 1997 also includes some provisions of relevancy to industrial safety. For example, section (78) of the Act prohibits any person to establish or make an extension for a factory without obtaining a license from the concerned authorities. In addition, section (85) obliges any owner or holder of a license for establishing a factory to submit to the concerned agencies within a period of one year from the date of attainment of the license an adequate report showing the number of his employees, their term of employment, the work environment, the available safety measures and any other required information that may be requested by the responsible authorities. In addition, sections (87) and (88) authorize the concerned authority to appoint industrial safety inspectors to implement the regulations prescribed under this enactment.

With respect to the petroleum operations, there are recent regulations entitled the "Regulations for Protection of the Environment in the Petroleum Industry 2002". These regulations were passed by the Petroleum Affairs Board in exercise of the legislative power delegated to the Board under section (3) of the Petroleum Resources Act 1998; the enactment which is now in force.

Pursuant to section (2) of the above stated Regulations, any agreement to be concluded in relation to petroleum operations must provide, among other things, the following:

a. The measures and procedures necessary for the protection of the land layers which contain the petroleum, metals and water.
b. The preliminary precautionary measures required to avoid environmental pollution during loading and unloading or transportation of petroleum by road, sea, river or air.
c. The contingency plan to overcome and control any environmental pollution or damage.
d. The follow-up process of care and attention as well as the good measures during the exercise of the petroleum operations to avoid environmental pollution.

e. An insurance certificate or financial guarantee to cover, restore and compensate the damage in the occurrence of environmental damage.
f. A study containing overall evaluation of the environmental impacts that are likely or definitely may result from the petroleum operations.
g. Adherence to any law or regulations that are in force.
h. An undertaking to be abided by any international environmental agreement to which the Republic of Sudan is a party.

For the purpose of the above stated environmental considerations, section (2) of the Regulations adopts a wide definition for “petroleum operations” to cover “all the exploration, drilling, exploitation, development, production, field development, refining, processing, storage, transportation, distribution, import, export and all operations accompanying the petroleum.” Similarly, section (2) indorses the holistic interpretation of the word “environment” to embrace the “total of natural systems and their basic components such as water, air, soil, flora, and including the socio-cultural systems, in which human beings and other organisms live and obtain their food and perform their activities.”

The regulations stipulated by the Environmental Health Act 1975 can also be resorted to, at least, to limit hazardous emissions to a minimum level. Section 13(1) of this Act sets out the following conditions for air pollution control:

a. Sources of pollution such as industries should be established at an appropriate distance from schools and public utilities.
b. The height of chimney should be reasonable to allow the spread of vapours, fumes, gases, and prevent their concentration.
c. Factories of chemicals, oils, or textiles, which discharge gases, shall be provided with cyclones and filters for the absorption of the gas or to decrease its concentration.

It is obvious that these regulations are not intended to eliminate air pollution, but rather to reduce pollution to a permissible level. Even though the Environmental Health Act is technically obsolete presenting “end-of-pipe” thinking rather than cleaner production and waste prevention concepts the act can certainly be utilised in the implementation of emissions and releases regulated by the Stockholm Convention. The act presents an applicable basic tool

enabling the authorities to assess the technical solutions but further specific regulations should be enacted to include the control of POPs emmissions.

The legislation and by-laws covering the public health are not directly relevant to the POPs issue and its further management. However, this sector is experiencing rapid technical change, which is reflected in the re-organisation of the roles of the central government and state governments regarding the public health issue.

2.2.5 KEY APPROACHES - ROAD MAP

The POPs issue in Sudan has been outlined. The situation in Sudan does not specifically differ from the situation prevailing in the neighbouring countries and Eastern Africa. There are no very serious hot spots or POPs release sources, which present immediate hazard for the environment or for humans. Therefore the first measure regarding all POPs categories is the development of the regulatory framework and raising awareness, both within the general public as well as within the groups who are directly in touch with POPs or are exposed to their adverse effects.

The management of POPs and mitigation of their impacts will be a joint effort of the public sector, businesses, industries and NGOs. Sudan plans in POPs issues are based on nationally set priorities, which point out the necessity of the activities to mitigate and prevent the adverse impact on environment and humans.

Some aspects of the POPs elimination require deep international cooperation. Sudan is of the opinion that destruction of certain pesticide substances could be made outside the country with much lower cost than ifit is done inside the country.

The management and phase-out of PCB is very much in the hands of the National Electricity Corporation. It is believed that the technical and technological development will lead to effective disposal of the contaminated transformers and that the government’s role is only to facilitate the development.

Unintentionally produced POPs in the industrial sector are technical and technological and good management/governance issues. The role of the government is to support and facilitate the owners of the

sources to transfer to new technology and new practices. Good international contacts, more training and pilot activities are essential to enhance the cleaner production methods, which lead to the reduction and elimination of the sources.

2.3. ASSESSMENT OF THE POPS ISSUE IN SUDAN

2.3.1 ASSESSMENT WITH RESPECT TO ANNEX A. PART I CHEMICALS (POP pesticides)

2.3.1.1. Production

Sudan has never produced any of the chemicals included in Annex A, part I. The Shell Formulation Plant (in Marinjan, Wad Medani, Gezira State) used to produce DDT and other POPs based formulations from imported active ingredients and solvents. The local formulation of some agrochemicals started in 1964 and formulation, storage and distribution of agrochemicals continued until 1991. The plant was used for the formulation and blending of a number of agrochemicals, which included DDT, Endrin and Aldrin as active ingredients. The same facility used to have an incinerator to get rid of the obsolete pesticides. Detailed figures regarding the production and delivery quantities are no more available. The total quantity of pesticides produced in 1973 – 1990 was approximately 21,000 tons. Since its closure in 1991 the site has been continuously monitored and recently (in 2005) a plan was made to clean the contaminated soil. Sudan has not exported any of the locally made pesticides.

2.3.1.2. Use and imports

Cotton cultivation in the Gezira started in 1911 on a small-scale of 250 feddans (Feddan =F= 4200 m²). The area increased to 50,000 F in 1925 by opening the Sinnar Dam. Currently, the total area of the Gezira Scheme is ca.2,000,000 F. The annual cropping structure is composed of wheat (ca. from 150,000 to 500,000F), cotton (from 150,000 to 500,000 F), sorghum (around 500,000 F), groundnuts (peanuts ca. 80,000 F), and vegetables (approx. 50,000 F). Cotton, as the main cash crop (total area: 417,222 F season 2003/04), is attaining a high consideration, especially from the protection point of view. The application of pesticides is directed mainly against the pest complex. The number (populations) of these pests fluctuates from

one season to another, and even within the same growing season. Moreover, the relative importance of each pest has changed over the years.

Large-scale insecticide spraying started in the scheme in 1945 to control cotton pests. Organochlorine insecticides (OCs) were the first to be used, namely DDT. By 1960/61 season, dimethoate (an organophosphate, OP) was introduced. Carbamates (viz. carbaryl = Sevin®) were applied starting season 1970/71. Pyrethroids were introduced commercially in season 1981/82.

Since 1945, a wide variety of insecticides were introduced; many of them continued in use either alone or in mixtures. Others, like DDT, were banned in 1981 **or severely restricted**, either for ecological or health hazard reasons or both. The reliable data for the types and quantities of the insecticides used in the Sudan Gezira is available starting 1966 (Appen. C). The last time chlorinated hydrocarbons (other than endosulfan) appeared in the list was season 1980/81.

During the period from 1945 to 1956, ground equipment, i.e. tractor-mounted sprayers and Land Rovers, were used for treating the crop with insecticides. Spraying by fixed-wing aircraft was introduced in 1950/51 season (Sudan was the first African country to use aerial spraying); by 1966/67 season all the insecticide spraying on cotton and wheat, in the Gezira and other schemes, was carried out by aerial spraying contractors. Still the herbicides are applied by using tractors.

Imports of some POPs for public health, and sugarcane plantations continued up to 1990s. As previously mentioned, the reliable data is only available starting the season 1966/67.

Toxaphene was not introduced as toxaphene alone since 1966/67; it was introduced as Torbidan (methyl parathion +toxaphene +DDT) or as Heliotox (DDT + toxaphene).

Endrin was withdrawn from the Sudanese market as early as mid 1960's because of its high acute mammalian toxicity.

Aldrin and Dieldrin were mostly used for the preparation of seed dressing of cotton mainly at 3 g per kg seed (Aldrex-T and Dieldrex-

B), and sometimes for rat control campaign and locust control (PPD and DLCO-EA). These two insecticides, in addition to Heptachlor and Chlordane, were the major recommended insecticides for controlling termites and white grubs in sugarcane plantations in Kenana, Assalaya, Sinnar, Ginaid, and New Halfa Sugar Factories.
Mirex has not been registered and hence never used in the Sudan.
Hexachlorobenzene is not registered or used as a pesticide in Sudan.
The imported quantities in 1966-1981 (Fig. 2.1), when the POP pesticides were actually used, fluctuated from 176 tons to 1068 tons. The very wide fluctuations between the years are difficult to explain. However, fluctuations may reflect, not the need or actual application quantities but commercial and logistical factors; part of the imported quantities were stored for the next season(s).

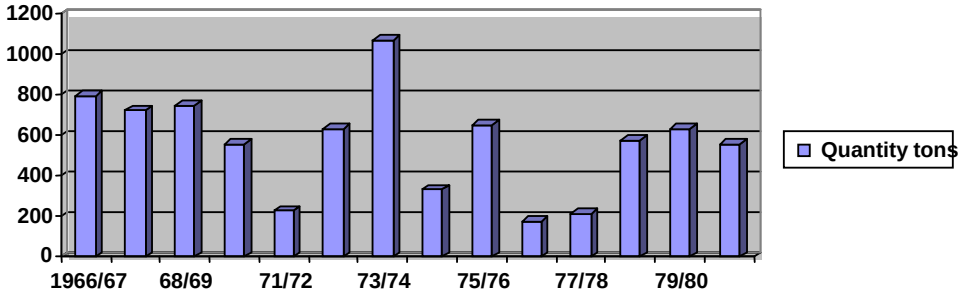


Figure 2.1. Imports of POP Pesticides during 1966 – 1981.

2.3.1.3 Registration of Pesticides

The registration system of pesticides is briefly explained below.

- Pesticides chemicals suggested for commercial use in the Sudan must go through a stringent system of testing and evaluation. No agricultural pesticide is accepted for commercial use without the permission of the National Pesticides Council (NPC). Upon recommendation by the National Pests and Diseases Committee (PDC), which is chaired by the Director General of The Agricultural Research and Technology Corporation (ARTC):

- Detailed chemical and toxicological information of newly introduced pesticides, in accordance with the Pesticide Act 37 of 1974, has to be submitted to the NPC (Same for the Act 1994).
- A technical committee (TC) emerged from the NPC shall study all the available data about the chemical (s). This committee raises its recommendations to the NPC to decide about the chemical.
- Accepted application (s) will be given permission to introduce only experimental samples to the country for testing.
- The experimental samples will then be handed to the relevant section of the ARTC to conduct the necessary experiments according to the regulations decided by the PDC.
- The testing of each chemical will be carried out by a working team headed by a research scientist.
- By the end of the test period, the scientist in charge of the chemical will present the findings before all PDC members; the latter will decide whether to pass or reject the recommendation (s) of the scientist in charge.
- Recommended chemical(s) will be passed to the NPC, together with all the necessary information to finally approve / reject the registration.
- Pesticides released by the PDC of the ARTC are subject to further validation test on the commercially grown crops at the agricultural schemes all over the Sudan in what is known as demonstration trials (5,000 to 10,000 F). Pesticide companies provide the product and ensure the compensation for any crop losses, due to the use of the product. The testing sites and the other requirements are arranged in coordination between the company and the scheme. Companies carry out such trials to display the efficiency of their chemicals.
- Pesticides that prove to perform as required are likely to be given a chance for nomination by the specialists when discussing the purchase of next season products.
- The Public Health pesticides and the Veterinary pesticides follow the same procedure.

2.3.1.4. Obsolete stocks, unused reserves, contaminated areas

All the abovementioned activities have left obsolete POP pesticides stocks, contaminated transportation equipment and contaminated the soil around the storage areas and areas where the transfer of the

substances took place. However, since the management of the agriculture schemes have been quite centralized in the different schemes the tracking of the obsolete quantities has been in practice possible. DDT has been extensively used in agriculture till 1980. Basically DDT use was allowed, till 1998, for vector control purposes only. It is also obvious that some volumes of DDT has been entering illegally into the country, but recently these quantities must have been very low.

HCENR carried out, under the current NIP development process, an inventory[3] of the obsolete stocks, contaminated containers and contaminated soil around the storage sites.

The pesticides inventory carried out allover the country: during September 2004 – March 2005 revealed the following quantities of obsolete pesticides stocked in 341 separate stores/storage sites in all states:

234 tons of obsolete pesticides substances.
528 tons of containers (some of them contain chemicals).
8850 tons (16000 m^3) of contaminated soil.
400 tons (approximately) of seeds dressed by POP pesticides

The inventory covered the largest storages, which are within the current agricultural schemes, but it is likely that there are old minor stocks, completely neglected and not recorded. All in all the quantities of the obsolete POPS pesticides might be a bit higher than the above mentioned 234 tons and also the quantities of contaminated containers and contaminated soil is also expected to be a bit higher. It is likely that the survey covered the largest concentrations in the areas with the most densities. The inventory obviously has the least coverage in the southern states and in the western areas (Darfur) due to the known conflicts at the time of the inventory.

[3]) The pesticides survey results are reported in detail in the report "Inventory of Pesticides, Obsolete Stocks and Disposal Opportunities by prof. Nabil Hamis Hassan Bashir, May 2005.





Plate 2. The conditions of some pesticide stores.

Table (2.1) shows the survey results by State. The pesticides are most scattered in Al Gezira State with more than 150 separate stores while in Kordofan, Darfur, Red Sea and Gedarif States the number of stores is small.

Table (2.1) indicates the total quantities of obsolete POP pesticides, contaminated containers and contaminated soil by State. Such total can be considered as a kind of “contamination index”. The Gezira, North Darfur, Sinnar and North Kordofan are the States with largest identified total quantities. The table also indicates the total quantities per capita of the rural population, which might be considered as an overall risk or impact index. The largest quantities per capita are in Sinnar, North Darfur and North Kordofan States, while the per capita quantities in theGezira State are lower despite thehigh absolute quantities. On the other hand in theGezira State pesticides are distributed over a large number of small stores, which present some kind of local hot spot, depending on the detailed location and conditions of the store.

Table 2.1 Obsolete POP pesticides, contaminated containers and contaminated soil in 2004-2005

STATE	TOTAL POPULATION IN 2004	No. OF STORES	IDENTIFIED PESTICIDE quantityS tons	ESTIMATED quantityS CONTAM. SOIL tons	ESTIMATED quantityS OF CONTAM. CONTAINERS tons	TOTAL PESTICIDES+ SOIL+ CONTAINER tons	TOTAL PER CAPITA, KG	TOTAL PER CAPITA, RURAL POPULATION
1. Northern	624,000	20	6,3	203,1	36,0	245,4	0,39	0.47
2. Nahr Alnil	972,000	17	13,7	235,9	0,0	249,6	0,26	0.40
3. Red Sea	734,000	6	0,1	5,0	2,0	7,1	0,001	0.03
4. Kassala	1,625,000	15	58,2	59,0	13,2	130,4	0,08	0.13
5. Algedarif	1,674,000	5	3,3	16,0	10,0	29,3	0,02	0.03
6. Khartoum	5,553,000	9	3,2	16,8	3,5	23,5	0,004	0.03
7. Algezira	3,797,000	156	13,3	2649,0	311,8	2997,6	0,79	1.03
8. Sinnar	1,301,000	16	0,0	1942,5	2,0	1944,5	1,60	2.13
9. White Nile	1,636,000	16	4,2	396,4	0,0	400,6	0,24	0.35
10. Blue Nile[4]	716,000	-	-	-	-	-	-	-
11. North Kordofan	1,578,000	20	0,4	1656,2	74,0	1730,6	1,10	1.66
12. West Kordofan	1,203,000	4	0,0	46,1	0,0	46,1	0,04	0.05
13. South Kordofan	1,174,000	14	1,0	629,0	1,9	631,9	0,54	0.72
14. North Darfur	1,655,000	12	130,0	730,6	18,1	2609,3	1,58	1.98
15. West Darfur	1,734,000	6	0,0	90,0	13,1	103,1	0,06	0.07
16. South Darfur	3,171,000	9	0,0	153,0	24,2	177,2	0,06	0.07
NORTHERN STATES	**29,147,000**	**325**	**233,7**	**8828,6**	**509,8**	**9572,1**	**0,32**	**0.54**
17. Upper Nile	1,506,000	5	0,0	5,0	0,0	5,0	0,003	0.005
18. Bahr El-Ghazal	2,550,000	3	0,0	2,0	2,0	4,0	0,002	0.002
19. Equatoria	1,310,000	8	0,0	15,0	16,0	31,0	0.02	0.03
SOUTHERN STATES[5]	**5,366,000**	**16**	**0,0**	**22,00**	**18,0**	**40,0**	**0,007**	**0.01**
SUDAN	**34,513,000**	**341**	**233,7**	**8850,6**	**527,8**	**9612,1**	**0,28**	**0.44**

Plate (3) shows the locations of the largest obsolete pesticide quantities in the country. (including contaminated containers and soil)

[4]) Blue Nile figures are included in the Sinnar State figures

[5]) The population of the 10 Southern States is consolidated into three larger regions. Bahr El Gazal, Upper Nile and Equatoria

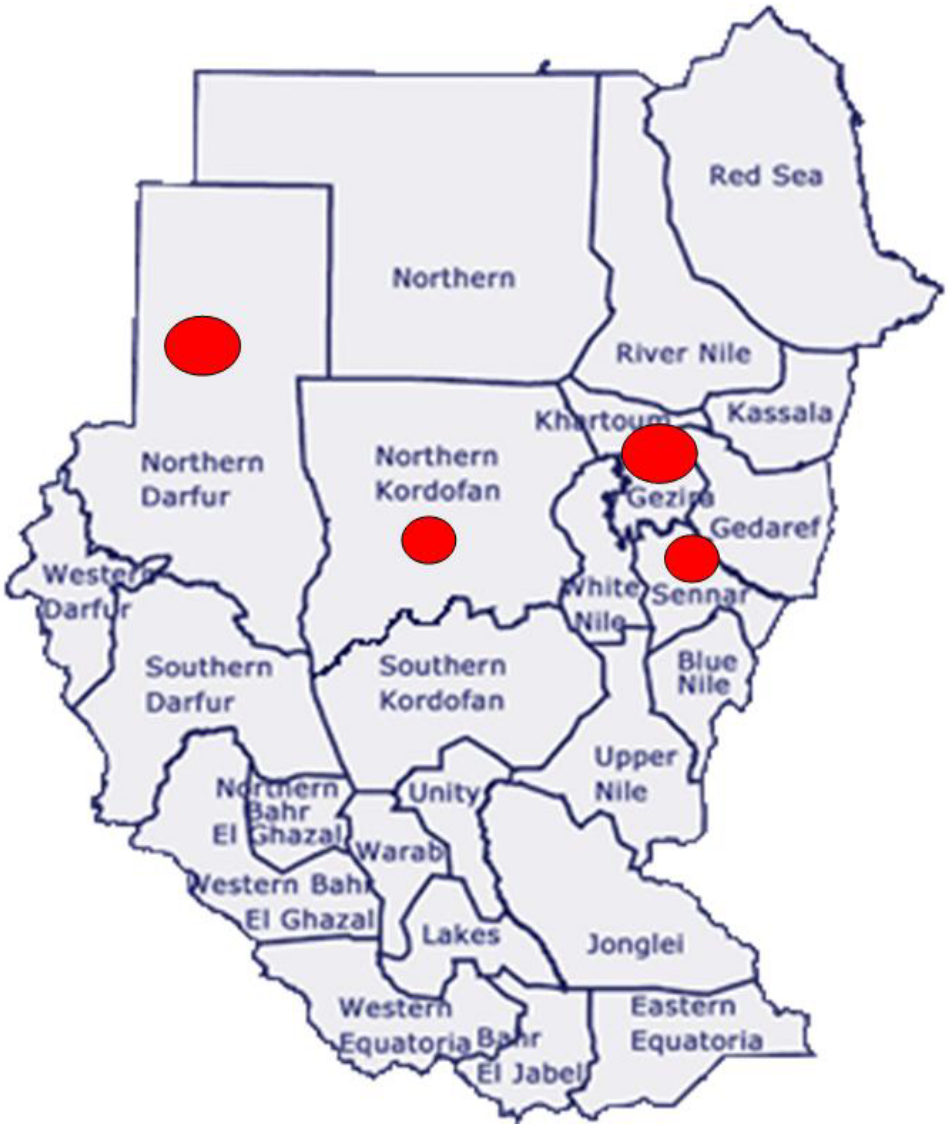


Plate 3. Locations of the largest pesticide quantities

2.3.1.5 POP Pesticides Impact

No systematic studies or other detailed monitoring data exist regarding the impact of pesticides in the environment, food and human health.

The concentration of certain pesticides in human blood has been sample-wise analysed in some typical agricultural areas. These analysis can be considered indicative only and due to lack of comparison and reference data, any far-reaching conclusion can hardly be made. Also the residues of certain pesticides in the soil in typical agricultural areas has been sampled and analysed. The lack of time series and lack of reference data doesn't allow any conclusions but the data, however, can be utilised in the forthcoming follow-up. Table (2.2) gives some indications of the impacts.

Table 2.2. Concentration of Persistent Organic Pollutants (pesticides) residues (ppb) in human blood in the different agricultural sectors in the Sudan, 1998 (A: Average, **R**: Range)

Area	**Average Concentration (ppb)**				
	No. of samples analyzed	**HCH**	**Heptac-hlor**	**DDE**	**Dieldrin**
Irrigated cotton schemes	67	A 23.55 R (0-92)	A 60.21 R (8-111)	A 163.41 R(30-380)	A13.46 R(0-58)
Irrigated sugar schemes	29	6.55 (0-22)	65.72 (28-93)	100.06 (21-167)	31.72 (10-82)
Riverine areas	40	7.04 (0-44)	11.89 (1.29-36)	31.55 (9-77)	4.65 (1.11-19)
Mechanized rain-fed areas	20	4.99 (0-29)	14.4 (2.29-82)	31.28 (3.8-174)	4.44 (0-11)
Traditional rain-fed areas	39	14.6 (0-36)	12.47 1.72-31	35.22 (12.8-87)	5.54 0-18
Grand average		11.346	32.938	72.304	11.962
Sample tested +ve %		86.15	100.0	100.0	98.64

Table 2.3. Average of Persistent Organic Pollutants (POPs) residues in soil of various agriculturalsector s in Sudan in 1996

Sector	Average Concentration in (ppm)				
	HCH	Aldrin	Hept-achlor	DDT	Diel-drin
Irrigated cotton schemes	ND	0.05	0.160	0.68	0.40
Irrigated sugar schemes	ND	ND	0.040	ND	0.13
Riveriane sector	ND	0.03	0.075	ND	0.17

ND: Not detected

The number of people exposed to the toxic pesticides, containers and to the land/soil contaminated with the toxic pesticides is difficult to assess. It is obvious that the people working at the currently operational pesticide stores are exposed to the highest risk. If one assumes that some 5-7 people are at least occasionally working in the stores, the total number of individuals at immediate risk are some 1500- 2000. Store locations near settlements and locations near water channels are most risky.

A survey covering the POPs in mother's milk is being carried out in 2006 with the support of HCENR during the present NIP development. The environmental and human impact is discussed more extensively in the sections 2.3.7 and 2.3.11 later in this report.

With the establishment of Sudanese Environmental Conservation Society (SECS), its collaboration with Friedrich Ebert (FE) foundation and coordination with the Higher Council for Environment and Natural Resources (HCENR) with funding from German Economic Development (DED) in late 80s and United Nation Development Programme (UNDP) mid-90s efforts in the area of environment awareness started to take shape and gain sustainability. However, the public awareness of the toxic pesticides is very low only the people immediately in touch with the substance being aware of the risks.

2.3.2 ASSESSMENT WITH RESPECT TO ANNEX A, PART II CHEMICALS (PCBs)[6]

Electricity was first introduced in 1908 in Sudan when a small 100 kW generator was installed. Since then, the electricity sector has passed a number of reforms and developments in its electric power capacity and extensions in transmission and distribution lines. In 1982, the government issued a decree formulating the National Electricity Corporation (NEC) as a statutory corporation under the Ministry of Energy and Mining to be responsible for electricity generation, transmission, and distribution in the Sudan. Later, the Water services were separated from Electricity.
In 1995, the total installed capacity was increased in the National Grid to about 307.6 MW. NEC grid system is the 220kV National Grid branched to 110 kV to the West and 110kV-66kV at the East of Sudan, besides fourteen (14) isolated grids in the main towns in the country.

Recently, since the year 2002, NEC, fully supported by the Government, has implemented fast track program which successfully added generation of 427 MW to the grid.

The electrification ratio of the Sudan (percentage of the population with electricity supply) is so low, estimated at about 15% of the country. Seventy percent of the available electric energy is consumed in cities namely Khartoum, the capital. NEC is competent, administratively and technically to run its business, this capability is achieved through almost one hundred years of experience with electricity generation and distribution.

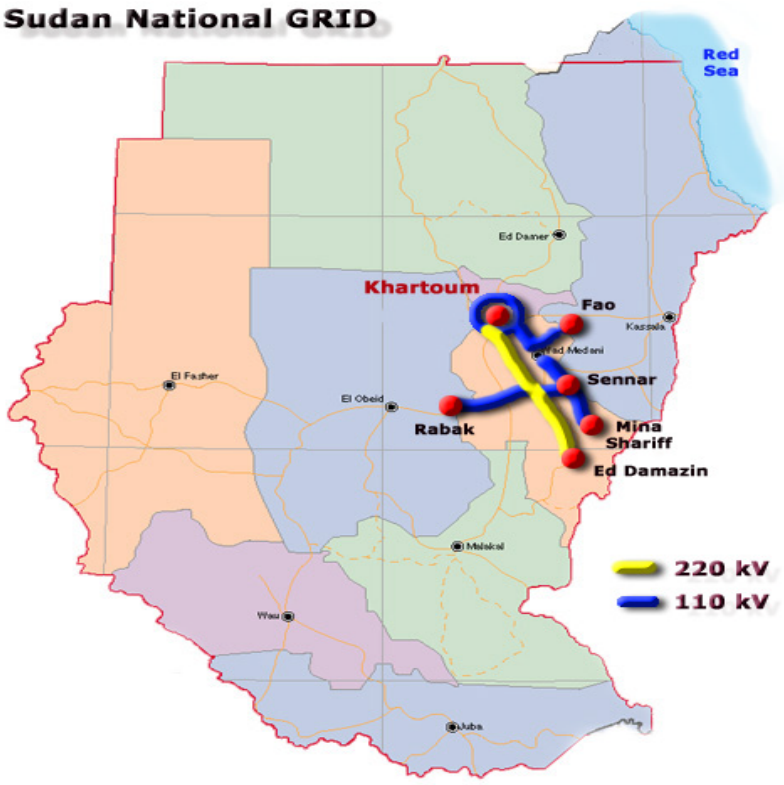
Plate (4) indicates the extent of the main national grid and the six operational areas of the National Electricity Corporation (NEC).
The technical management of the network is in fact ensured by the staff of NEC with regard to:

- Supply of new material:
- New transformers
- The purchase of mineral oils

[6]) The PCB assessment is based on the Preliminary Inventory Report of PCBs. Higher Council for Environment and Natural Resources. September 2005

- Maintenance of the equipment :
  - Transformers
  - The filtration of mineral oils
  - Phase out of the apparatus at the end of the lifetime:
  - Recycling of metals
  - Recycling of oil

NEC owns almost all the transformers in Sudan. These transformers include transmission, distribution, and generation, the amount totals to around 15000 transformers, mainly for distribution.



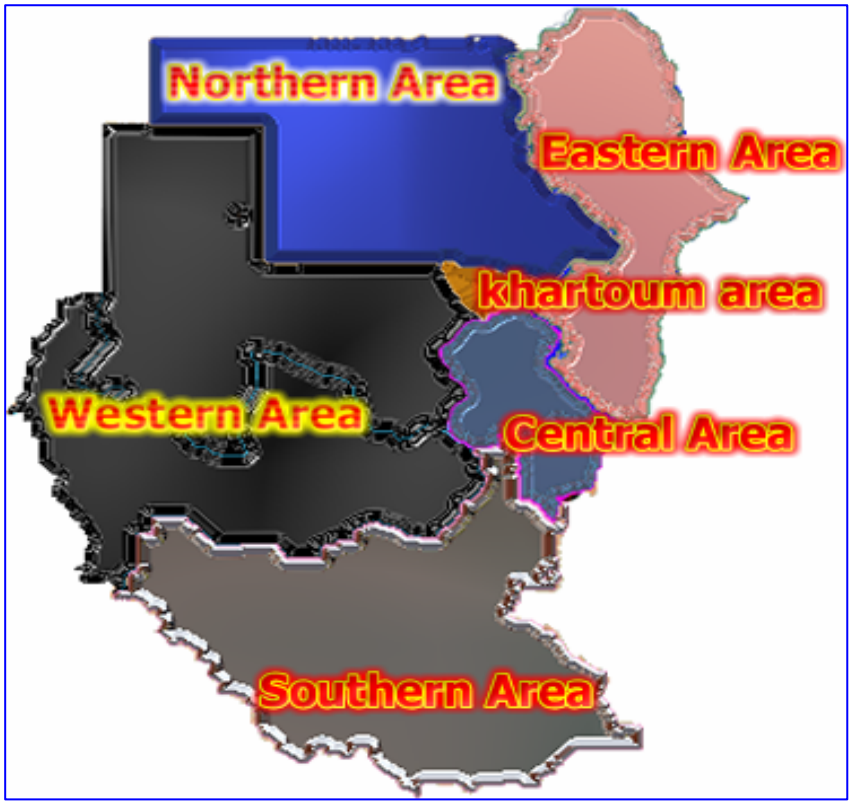


Plate 4. : National Electricity Grid and Operational Areas of the National Electricity Corporation

For the difficulty of testing all the transformers for PCB, a preliminary inventory covering 10% of the transformers was carried out in 2005. This preliminary inventory, based on sample of approximately 10 % of the transformers in use, was designed to be representative regarding all the relevant characteristics of equipment in use. For the inventory purposes the country area has been divided into six geographical zones, which are the operational areas of NEC (see plate 4.), i.e. Khartoum Area, Central Area, Eastern Area, Western Area, Southern Area, and Northern Area. Each zone was covered by a task group equipped with test kit, cameras and budget to facilitate the inventory activities.

The total weight of the transformers in the country (15000 units) is approximately 68731.5 tons, of which 18001.7 tons (26 %) presents the dielectric liquid and 51335.7 tons (74 %) the “dry” equipment (table 2.6). Regarding the contamination level table (2.4) indicates the total weight of the equipment, the weight of the dielectric liquid, and the weight of the drained transformers and the state of PCB contamination. The rate of contamination in Sudan was found to be relatively low (2 %) compared to other African countries (around 20 %) and Asian countries (around 50 %). The estimated quantity of PCB in liquid phase (stored at the NEC’s premises) is about eight tons while the quantities of PCB and PCB contaminated dielectric in the equipment are 246.3 and 32.5 tons, respectively.

Tables 2.4 and 2.5 summarise the results of the inventory, extrapolated to cover the whole estimated transformer population of 15000 in the country.

Table 2.4. Total estimated transformer population and PCB contamination.

Type of equipment	Type of dielectric	PCB Classification	No. of Units	Total Weight (ton)	Dielectric weight (ton)	Dry weight
Transformer	PCB oil	PCB	82	498.8	63.5	435.3
Transformer	Mineral oil	PCB Assumed Until Negative Test	71	391.8	88.9	302.9
Transformer	Mineral oil	Non PCB	6268	27647.3	7008.9	20827.8
Transformer	Mineral oil	Non PCB	4874	23855.8	6302.7	17815.1
Transformer	Mineral oil	PCB	103	516.9	165.3	351.6
Transformer	Mineral oil	PCB Contaminated	62	142.0	32.5	109.5
Transformer	Mineral oil	PCB Contaminated Mineral Oil Until Negative Test	3386	15221.2	4141.3	11183.5
Transformer	Retrofilled Assumed	Non PCB	10	7.2	1.9	5.3
Transformer	Retrofilled Assumed	PCB	10	19.5	9.5	10.0
Transformer	Retrofilled Assumed	PCB Contaminated Mineral Oil Until Negative Test	31	160.2	65.4	94.8
Drums containing PCBs liquid phase	Mineral oil	PCB	21	34.4	8.0	26.4
Capacitor	Mineral oil	PCB Assumed Until Negative Test	10	8.4	2.2	6.2
Capacitor	Mineral oil	Non PCB	31	194.2	102.6	142.3
Capacitor	Mineral oil	PCB Contaminated Mineral Oil Until Negative Test	41	33.7	8..9	24.8
TOTAL			15000	68731.5	18001.7	51335.7

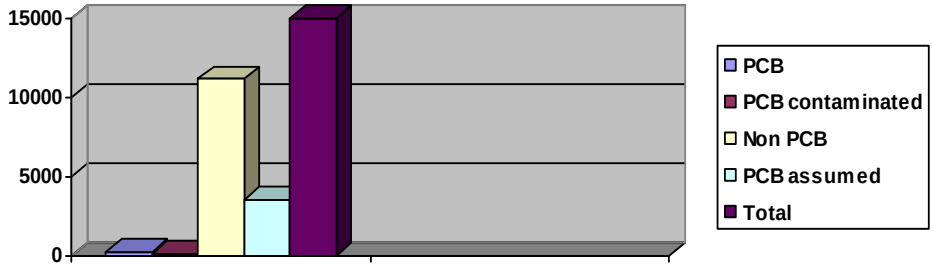
Out of the 15000 transformers only 1.44 % are using PCB as dielectric and further 0,41 % have PCB contaminated dielectric liquid. However, it is clear that part of the transformers being “PCB assumed” might prove to be “PCB contaminated” after more detailed tests.

Table 2.5. Transformers according to PCB contamination

The following histogram summarises the distribution of the

STATE OF CONTAMINATION	NUMBER OF UNITS	%
PCB	215	1.44%
PCB CONTAMINATED	62	0.41%
NON PCB	11183	74.56%
PCB ASSUMED	3540	23.60%
TOTAL	**15000**	**100.00%**

transformers according to the contamination state.



TYPE	TOTAL WEIGHT TONS	%	DIELECTRIC WEIGHT TONS	%	EQUIPMENT WEIGHT TONS	%
PCB	1069.7	1.5	246.3	1.4	823.4	1.6
PCB CONTAMINATED	142.0	0.2	32.5	0.2	109.5	0.2
NON PCB	51704.4	61.8	13416.2	74.5	38790.4	75.6
PCB ASSUMED	15815.4	23.0	4306.7	23.9	11612.3	22.6
TOTAL	68731.5	100.0	18001.7	100.0	51335.6	100.0

Table 2.6. Disposal weight of transformers according to the contamination rate

2.3.3. ASSESSMENT WITH RESPECT TO ANNEX B CHEMICALS (DDT)

DDT has not been used in Sudan for agricultural purposes since 1981. After that, till 1998, DDT was used for malaria vector control only with annual quantities of 100 tons in average. Officially DDT use in Sudan is restricted to disease vector control and the official malaria management administration is monitoring the use. The government is managing DDT in accordance to the WHO recommendations and guidelines of the National Pesticide Council since locally safe and effective alternatives are not attainable. The development of alternative vector control measures as well as the monitoring of the resistance is going on, but the government hardly has the sufficient resources to enhance the control process.

There are strong indications that malaria is increasing in Africa and as well as in Sudan (table 2.7). The main reason, according to several opinions, being the reduced DDT use without suitable and/or effective alternative means for the vector control.

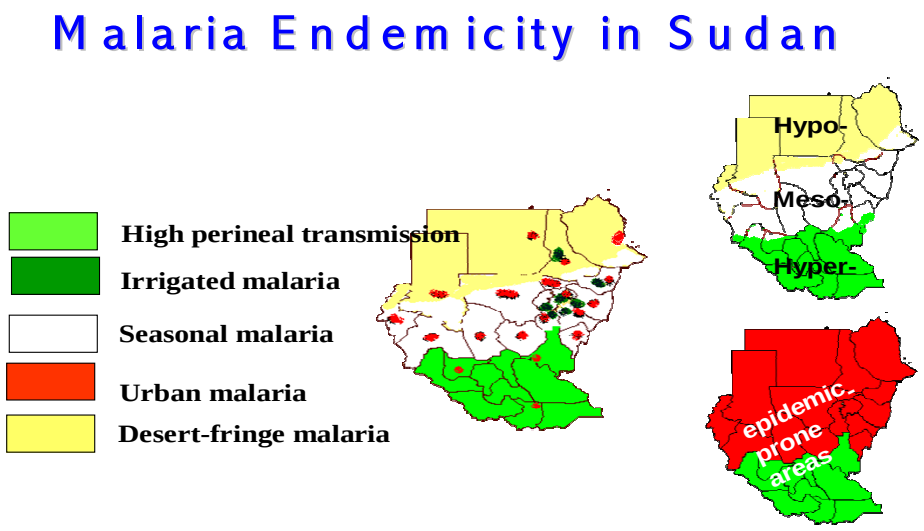
Table 2.7: Malaria epiodemiology in Sudan.

Area	Type of endemicity	Annual parasite incidence of total population (%)	Population	Malaria intensity
Desert areas	**Hypoendemic**	**3.8**	**1,000,000**	**Unstable**
Poor dry savanna	**Mesoendemic**	**4.8**	**20,000,000**	**Unstable**
Rich wet savanna	**Hyper endemic**	**1.5**	**4,000,000**	**Stable**
Urban areas	**Mesoendemic**	**0.3**	**5,000,000**	**Unstable**

DDT use has a long history and application practices are deeply rooted in the people. Potential alternatives for the DDT use being studied in Sudan are e.g. the following:

* Source reduction (filling in of breeding sites & intermittent irrigation)
* Biological methods
* Use of chemicals and oils (e.g. Abate)
* Space spraying (during emergency)
* Indoor residual house spraying (IRHS)
* Insecticide-treated bed nets (ITNs)
* Repellents
* House improvement

Plate 5 delineates the malaria endemic zones in Sudan.



The history of the malaria control programmes in Sudan can be summarised as follows:
* Pre-insecticide era: 1904 – 50.
* The insecticide era: 1950– 65.
* The beginning of insecticide resistance: 1966 – 70
* The malaria crisis era: 1970 – 75.

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[7]) Source: Dr. Mustafa Y. H. Dukeen (Vector Control Focal Point Federal Ministry of Health/Malaria Administration,Khartoum, Sudan): The Second National Conference on Pest Management. University of Gezira, Faculty of Agricultural Sciences. Wadi Madani, Sudan. 6-9 December 2004.

* Externally assisted program: 1975 – 80.
*Blue Nile Health Project Era: 1980 – 90/92.
* WHO Supported program: 1990 – 98.
* Specific WHO supported Roll Back Malaria: 1998 – Present

2.3.4. ASSESSMENT OF RELEASES FROM UNINTENTIONAL PRODUCTIONS OF ANNEX C CHEMICALS, UPOPS (PCDD/PCDF; HCB and PCBs)

2.3.4.1. The Composition of UPOPs Emission Sources

The survey carried out in 2004-2005 under the NIP activities, using the dioxins and furans tool ki, covered the sources of PCDD/PCDF, HCB and PCB as mentioned in Annex C, part II and part III of Stockholm convention. Out of these source categories the most common in Sudan are shown in Table 2.8: [8]

Table 2.8 Summary of UPOPs Emissions/Releases in Sudan

Source Categories	Annual Releases (g TEQ/a)						
	Media						
	Air	Water	Land	Products	Residues	Total	%
1. Waste Incineration	0.203	0.000	0.000	0.000	0.000	0.203	00.02
2. Ferrous and Non-Ferrous Metal Production	5.612	0.000	0.000	0.000	1.1	6.712	00.68
3. Power Generation and Heating	24.133	0.000	0.000	0.000	0.000	24.133	02.43
4. Production of Mineral Products	0.214	0.000	0.000	0.000	0.000	0.214	00.02
5. Transportation	0.178	0.000	0.000	0.000	0.000	0.178	00.02
6. Uncontrolled Combustion Processes	345.240	0.000	52.409	0.000	535.6	933.249	94.11
7. Production of Chemicals and Consumer Goods	0.000	0.000	0.000	23.992	0.000	23.992	02.42
8. Miscellaneous	0.000	0.000	0.000	0.000	0.000		00.00
9. Waste Disposal/Landfills	0.000	0.000	0.000	0.000	2.900	2.900	00.29
10. Identification of Potential Hot-Spots							
Total	375.600	0.000	52.400	24.000	539.600	991.600	100.00
%	37.88	0.00	5.29	2.42	54.41		100.00

[8]) Out of the source categories in Annex C/Part II, cement kilns firing hazardous waste, secondary zinc production, and categories in Annex C/Part III, specific chemical production processes, crematoria, shredder plants for the treatment of end of life vehicles, and waste oil refineries, could not be identified in Sudan.

The uncontrolled combustion processes account for more than 94 % of the UPOPs releases in Sudan. Power Generation and heating and the production of chemicals and consumer goods count for approximately 2,4 % each. Third largest release/emission source is the secondary metal production, i.e. melting and further processing of scrap metals, iron, copper and aluminum.

Air as a media (38 % of the estimated releases) moves the substances long distances and is thus difficult to assess. As a reference it may be noted that the total emissions to air in the EU area (15 “old” member states) are estimated at approximately 6500 g TEQ p.a., i.e. Sudan’s releases are some 5-7 % of the EU’s releases.

The inventory concluded that dioxin and furan are not released to water since they are water insoluble but it is clear that water, rains and surface water streams can carry dust/land and residues containing dioxins and furans.

Land/soil as a media (5 % of the releases) to carry/contain dioxins and furans is usually stable in that sense that it doesn’t move and also the substances in it may not move quickly. However, little is known about the interface of surface water/land and air(winds and storms)/land and how these affect the movements. The above said is relevant when estimating the geographical extension of the releases.
Products, i.e. chemical and certain consumer goods are estimated to contain some 2 % of the releases. These are basically easy to trace and follow-up.
Residues present more than half (54 %) of the media into which the dioxins and furans are released. Residues are in practice waste from households and industries. It is likely that an essential part of the dioxins and furans released to residues transgress little by little to land/soil, to air (through winds, storms) and also to water (Fig. 2.3).

Figure 2.3. Dioxin and furan releases/emission by environmental media

2.3.4.2. Emissions by Source Categories

The following sections briefly describe the UPOPs sources and comment/assess the practices.

Waste incineration makes 0.02 % of the total releases, all to the air. The releases are produced when incinerating contaminated blood in hospitals, less than 1 ton p.a., and when incinerating animal carcasses (estimated at some 400 tons p.a.) rejected in slaughterhouses. It is likely that e.g. the quantities of the carcasses destroyed is higher than 400 tons p.a. as identified in the survey; part of the incineration is just plain uncontrolled burning. No municipal solid waste incinerators exist in Sudan. Solid wastes are often treated by open burning. Since there is no hazardous waste management and classification in the country, their management by incineration or any special means does not exist. However, on the other hand this raises the pressing question what Sudan does e.g. with hazardous industrial waste and hazardous hospital waste in particular if and to which extent hazardous waste or medical waste is destroyed by open burning (as a large share of municipal waste) or if this critical waste is being put on landfills or otherwise released into the environment.
Basically using high calorific waste in industrial facilities, as secondary fuel is a win – win situation. The industry acquires cheap energy resources and even additional money for accepting and treating the waste (e.g. in Europe). The country acquires a good solution for recycling part of the waste

However, the respective facilities need to be controlled in order that they can treat the waste in an environmental sound manner.

For Sudan, in a preliminary evaluation, four industry sectors were discovered which might be suitable for the thermal recycling of waste: Cement kilns, shaft kilns for lime production, power plants and kilns for brick production.

The production of ferrous and non-ferrous metals accounts for 0.68 % of the total dioxin and furan releases in Sudan. Of the total 84 % is released to air, the remaining in residues (slag, ash, industrial waste). Business/product wise the releases are shown in table (2.9)

Table 2.9. UPOPs releases in ferrous and non-ferrous metal production

Sector	Release(g TEQ)	Media
Iron and steel production	0.7500	Into air and residues
Foundries (recycling)	0.0310	Into air
Copper (from scrap)	0.0514	Into air and residues
Aluminium	0.9060	Into air and residues
Brass and bronze	0.0050	Into air
Metal/copper wire reclamation	5.0000	Into air
Wire reclamation (from tyres)	0.2700	Into air

Only one big plant (Giad Company) produces steel in large quantities in an electric arc furnace (EAF). The steel is produced from metal scraps collected from different parts of the country. Its annual production estimated to be 30000 tons and is used mainly for buildings and constructions.

There are many foundries engaged in metal recycling located in main industrial areas. Furnaces used in these foundries are locally made and all of them do not have air pollution control systems. The annual production of these foundries is estimated at 3100 tons p.a.

Copper is produced from scrap materials. Total annual production is 36 ton, produced in two facilities. In the facility of Sudan railways copper is melt in a big pot without any ventilation of the toxic fumes or any air pollution control system. These airborne emissions consist of dust and metal compounds, organic carbon compounds including PCDD/PCDFs, further NOx, SOx and carbon monoxide (CO). The small old suction system did not function at all. Most of the workers do not have any protection measures. Basically they directly inhale the toxic fume evaporating from the melting pot. The slag was discharged in a corner of the hall directly on the soil (the hall does not have concrete floor but is built directly on the soil). In addition oil is spilled all over on the ground further contaminating the soil. From the standpoint of workers' health and environmental protection the current practice should be stopped.

Many local foundries re-melt aluminium scraps. The product is reformed and shaped for different purposes. This thermal process is performed in facilities, which have no dust removal or any pollution control system. Total annual production is estimated at 2184 tons p.a.

Total annual brass and bronze production is 481 t.

In Sudan at the time of the PCDD/PCDF inventory three small enterprises were discovered to burn cables. The total annual amount burned in 2003 was estimated at 1000 tons. However, there are probably more enterprises and individuals active in this business. Most of the cables are burned outside cities in industrial areas emitting the toxic fumes to the neighbouring companies. Due to the high PCDD/PCDF emissions these sites are sources with potential high emissions (the emissions of the three enterprises were estimated to be 5 g TEQ/a) and therefore have potential impact on the human heath of workers and the neighbourhood.

Tires containing metal wires are burned for wire removal. The wire is then used mainly for building construction. In total 54 tons of tires are burned per year in rural areas. This practice is especially hazardous and poses big risks for the people and ecosystems in the vicinity of the sites where the burning is done.

Power generation and heating presents 2.43 % of the total dioxin and furan production, releases into the air. It is obvious that some toxic substances remaining in the residues (bottom ash) but the quantities are small. The dioxin and furan releases sector wise are shown in table (2.10).

Table 2.10. UPOPs releases in power generation and heating

Sector	Release(g TEQ)	Remarks
Fossil fuel power plants **-19 power electric stations** **-Industrial power stations**	0.11 0.35	Sources easy to locate Some 565 facilities at industrial scale
Biomass power plants	0.26	Used at sugar factories only
Domestic heating and cooking with biomass	28.55	In practice all the population is exposed excluding a small fraction of urban population in largest cities
Domestic heating and cooking with fossil fuels	0.01	Small number of people in the central urban areas.

Power generation for the electricity production and industrial purposes presents a rather small fraction of the dioxin and furan releases in Sudan. The number of people at risk can be estimated as the workers employed by the electric and industrial power plants were estimated plus the family members and other people living in the vicinity of the plants.

The biomass (charcoal and wood) burning presents the largest immediate health risk. In addition, it has become evident that high dependence on biomass energy is a major factor contributing to forest cover depletion, environmental degradation and desertification in Sudan. Burning wood and charcoal (also animal dung used) for domestic heating and cooking is, however, a necessity and naturally a deeply rooted practice in Sudan. A recent study estimates that replacing wood and charcoal with LPG could reduce the level of indoor air pollution by more than 80 %. One can say that the domestic prolonged exposure to biomass fuel smoke is a significant cause of health problems such as acute respiratory infection in children, chronic lung diseases (asthma, bronchitis), lung cancer and pregnancy related problems. The emerging use of LPG as a

domestic energy (and lighting in rural areas) source presents also dioxin and furan source, but the magnitude is just fractional compared with the wood and charcoal.

Production of mineral products presents approximately 0.02 % of the releases, almost all to air. Sources are easy to locate, i.e. two cement kilns, one lime shaft kiln accounting for approximately half of the releases while one fifth comes from the brick production and the rest from asphalt mixing. The employees as well as people living in the vicinity of the sources are exposed to the risks.

The number of traditional brick production sites is obviously one thousand scattered all over the country but the Nile banks in the central part of the country presenting the largest concentrations. There are three mechanised brick production plants, which count approximately for 45 % of the total production of dioxin/furan releases. Releases present a risk to the employees. It may be noted that most of the brick-making plants are near to the densely populated areas at the outskirts of larger cities and towns and the smoke from the burning process is widely dispersed over the housing areas. It may be noted that the brick industry (also the traditional plants) have made trials to replace wood with LPG as an energy source in the brick-burning. LPG is, as an energy source, cheaper and more efficient than wood, but the burning technology requires more development and fine-tuning to result in good quality products.

Transportation presents some 0.02 % of the total toxic dioxin and furan releases in Sudan, i.e. the same volume as the production of mineral products. All two-stroke, four-stroke and diesel engines present release sources. The impacts and exposure are naturally concentrated in the areas where the vehicles move, i.e. in the urban areas and in the main traffic lanes between the largest settlements. The number of vehicles is rapidly increasing, which naturally leads to increasing releases.

Uncontrolled combustion processes make more than 94 % of the dioxin and furan releases in Sudan. Out of the toxic substances some 57 % are released in residues (ash and incompletely burned remains), some 37 % in air and the rest in land/soil. Table (2.11) summarises the UPOPs emissions from uncontrolled combustion.

Table 2.11. UPOP emissions from Uncontrolled Combustion

Sector	Release g TEQ	Remarks and impacts
Forest fires	98.29	Releases to air and land/soil half-and-half
Burning of agricultural residues	30.88	Is generally considered beneficial for soil improvement and reduced need for pesticides
Accidental fires in houses and factories	1.29	Impacts difficult to assess. Mainly people in the vicinity of the fires
Uncontrolled domestic waste burning	802.46	All urban population, 10 million people exposed to smoke and particulate matter released
Accidental fires in vehicles	0.01	Impacts difficult to assess

Forest fires present approximately 10 % of the total releases in Sudan. Most of the fires are naturally unintentional, but it is obvious that forestry areas are also intentionally cleared by burning.

Burning agricultural residues is an old practice in Sudan. Burning sugar cane leaves before harvesting is a required practice to facilitate harvesting in an area of about 25000 feddans. The number of people exposed to the releases, mainly to air, is difficult to estimate.

Accidental fires of houses, industrial buildings and vehicles present certainly a source of dioxin and furan releases, and obviously potential sources of PCB releases. The impact and number of people exposed are difficult to estimate. However, fires in the urban areas and in industrial areas are most likely dangerous and immediate sources of toxic substances. The authorities (Civil Defence Department) might have some advance information about the most risky locations with e.g. large chemical stores.

Uncontrolled domestic waste burning (including waste burning from commercial establishments and small industries) accounts for approximately 80 % of all the estimated dioxin and furan releases in Sudan. The environmentally sound waste management, i.e. separation, collection and proper disposal, is in its infancy in Sudan. However, some surveys and studies have been made covering the

waste issue, especially related to the recently started and now working waste management scheme in Khartoum.

The waste generated per household is estimated at 3.78 kg/household/day in Khartoum. The number of households is approximately 1 million, which gives some 3700-3800 tons as the daily waste quantity. On top to that quantity comes some 600-650 tons of industrial waste and 170 tons waste from commercial establishments and markets per day. Thus the total waste quantity is approximately 4500 tons per day. Rough estimates indicate that total waste generated in other urban areas (outside Khartoum) are approximately 7500-8000 tons per day and thus the grand total for whole Sudan 12000-13000 tons per day.

The composition of the waste has been preliminarily analysed as follows:

Organic matter	30 %
Inert matter	55 %
Paper and board	4 %
Glass	1,3 %
Metals	2,3 %
Wood	1,2 %
Plastic	2,6 %
Textiles and leather	2,5%

Organised waste management of household (including small businesses, industries) is established in central urban areas of seven states. Totally these states count for almost one half of Sudan's population. The urban population in these seven states is approximately 8-9 million and thus the basic waste management, collection, and organised disposal (even though not a managed one, except in a few areas) covers thus some 7 – 7.5 millions, i.e. 80-90 % of the urban population in the central areas is somehow covered or at least have an opportunity to utilise proper waste collection services. In other urban areas there are some initial arrangements made, mainly centralised transportation of waste.

Table 2.12 Areas Covered by Organised Waste Management

State/Urban area	Population in million[9]	Covered by waste management service, %	Waste collected per day
Khartoum	5,7	65	1752
Al Gezira	3,4	40	750
White Nile	1,5	32	375
Blue Nile	0,7	40	40
Sennar	1,2	10	10
Al Gedarif	1,5	50	50
Kassala	1,6	40	40
Total			**3017**

Approximately 3000 tons out of the estimated total of 12000 tons, i.e. 25 % is somehow managed (table 2.12). There are no managed landfills in Sudan (in Khartoum a new managed landfill is being opened in 2005-2006).

It is estimated that some 10 % of the waste is not managed, but burned in the vicinity of the sources and the rest is just dumped.

There is no active waste separation in Sudan, but in the market there are several companies/organisations collecting certain waste fractions for reprocessing. A large part of waste metal is separated in some stage of the waste collection process. Also paper (board, cartons) as well as plastic is separately collected for reprocessing. However, there are no reliable data Source separation does not exist. The Khartoum State waste management organisation is initiating the waste separation at the new landfill site aiming at separating the combustible material, metals, paper and board and hazardous components from the waste stream.

The Khartoum State waste management organisation is actively promoting the general awareness about the waste issue.

[9]) The population estimates used in the waste survey are independent and thus not exactly the same as other estimates in this report.

Production of chemicals and consumer goods counts for 2.42 % of the total dioxin and furan releases, i.e. approximately the same as power generation and heating. In practice all the toxic substances are generated in the 17 leather tanneries and all the releases are in the products, i.e. in hides processed. The impact and exposure follows the products ending up with the goods made of hides. An essential share of the products is exported. It may be noted that tanneries produce large amounts of effluents, which are in no way managed or treated. The effluents contain e.g. toxic metals like chromium. The effluents present a much bigger, immediate and tangible environmental risk than the dioxins and furans in the tannery products.

Recycling of paper and cardboard as well as textile industry produce dioxins and furans, which are released with the products. The estimated releases are 0.007 g TEQ and 0.225 g TEQ, respectively. The impact and exposure obviously present a very small risk.

It may be noted that the imported consumer goods also contain dioxins and furans. However, Sudan doesn't present any specific characteristics in the importation regarding the dioxin and/or furan contamination.

Waste disposal and landfills present an estimated 0.29 % of the total unintentional POPs production in Sudan. For the purposes of the toolkit (theoretical UPOPs emission calculation model applied), landfill is a controlled engineered waste site where as thedump is largely dump site contains mixed waste that was disposed of without any pollution prevention devices. In Sudan all disposal sites are unmanaged and can be classified as dump sites. Most are close to the residential areas.

The passage of water in rainy seasons through waste causes leachate escaping in uncontrolled manner. Since the rainfall has a large variation in the different vegetation zones in Sudan and the area of waste dumps is difficult to estimate, the PCDD/PCDF emission from this subcategory cannot be calculated. Sewage system, with proper sanitation network in Sudan, exists only in Khartoum and meets the demands of about 0.5% of the population and small parts of industrial area. Soba Sewage Treatment Plant (Plant 1) serves part of central Khartoum and part of Khartoum South Industrial area. Its annual flow estimated to be 11953080000 litres.

The wastewater is biologically treated in stabilized ponds. The second sewage treatment plant was located in Khartoum North (Plant 2) which serves only small part of the industrial area. Its annual flow estimated to be 727272000 litres. In this plant no method of wastewater treatment is applied.

Most industries discharge their wastewater on land or open dumping. No compiled data exist for such discharge. Household wastewater is disposed of in open pit latrines and in septic tanks. This practice is only found in urban areas. Also no figures were available for the percentage of domestic wastewater or sludge treated by different systems (septic tanks, pit latrines etc.). In rural areas waste water is disposed of directly on land. Also no compiled data exist for such discharge. Therefore an estimation of PCDD/PCDF release from this source is not possible at present.

Used oil collected from cars and other motors is used in some industry, however at present the amount can not be estimated

In restaurant and canteens the oil is totally consumed and therefore no waste oil result from food businesses.

Hot spots: The survey of the unintentional POPs production did not identify any specific potential hot spots with remarkable dioxin/furan related toxic releases. However, one can point out the largest industrial plants in metal production as well as the brick manufacturing concentrations, present (relative) local hot spots.

2.3.5 INFORMATION ON THE STATE OF KNOWLEDGE ON STOCKPILES, CONTAMINATED SITES AND WASTES

The obsolete pesticide stocks are described in chapter 2.3.1. The number of stores, more than 340 all over the country, is posing some problem regarding proper control and management of the obsolete stocks. Since most of the stores are used to keep non-POP pesticides and other agro-chemicals the monitoring of the remaining POPs substances requires good coordination. Naturally these obsolete pesticides, being redundant, present some extra costs and require some extra effort. There is no clear ownership and responsibility for the stocks that have no economic value but are burden and nuisances. Therefore, it is recommended (as discussed later in this report) that the obsolete pesticide stock will be

concentrated in a fewer number of locations and, finally, in one place in the country.

A quantity of approximately 20 tons of POP pesticides are dumped and covered by a concrete container in Hasahisa. This place is not posing any immediate risk, however, needs to be addressed in any forthcoming actions plans.

Sudan has some 400 tons of contaminated seeds (dressed with pops pesticides) which can be regarded as hazardous waste.
A pesticide formulation and mixing plant in Wad Madani was operating from 1960s to 1991 when the plant was closed. The production site has experienced some leaks and accidents. The chemical residues in the soil present some possible risk for the potential future land-use of the site. The site has been monitored since its closure and a remediation plan has been made, expected to be implemented in 2006-2007.

PCB quantities (approximately 8 tons) in liquid state and/or as a contaminating ingredient in mineral oils are rather small and located within the NEC facilities.

The inventory of the unintentional production of POPs didn't reveal any serious hot spots or seriously contaminated sites, but the following can be mentioned and need some attention in the future:

In some cities the industrial solid waste and the municipal solid wastes is compacted and dumped in pits without any separation. The filled pit is closed and the next pit is opened and filled. These filled pits may have negative impacts on ground water due to leachate migration and the possible emission of gases. Most of the large industrial facilities, like sugar factories, tanneries, and textiles dispose off their waste water either in rivers or open land. In some parts of cities, especially around industrial areas copper cables, tires and other solid wastes are burned on the ground making the area a potential hot spot.

The Soba landfill near Khartoum, a major dumpsite for municipal waste, will be closed in the near future. This site presents a possible leaching hazard and should be monitored carefully.

In 1998 El Shifa Pharmaceutical Factory in Khartoum North was hit by American missile and all equipment, chemicals and products are exploded. The site should be considered as a possible reservoir of PCDD/PCDF.

In 2002 a large power station in Khartoum (Buri Power Station) was accidentally burnt. Certainly many transformers and capacitors which may contain PCB had exploded and made the site a possible reservoir of PCDD/PCDF.

Some reprocessing sites of scrap metals, even though rather small by size, can be regarded as hot spots or at least very problematic and intensive local dioxin and furan sources, which present a high risk for the employees as well as for the people living in the vicinity of these production places. The copper processing plant of the Sudan Railways Corporation should be mentioned as well as a hot spot, where the cable smouldering is being done.

The large GIAD industrial complex near Khartoum is running several processes producing and/or likely to produce dioxins and furans. Even though GIAD complex cannot be pinpointed as any specific hot spot the sheet volumes of the processes make it a potential environmental hazard, which should be closely monitored.

Brick manufacturing sites near the human settlements present local contamination and pollution sources, which deserve further attention.

All the above information regarding hot spots and possible adverse impacts are based on the secondary data (except the information about the pesticides formulation company former plant, which has been studied and analysed based on accurate laboratory tests) and subsequent theoretical calculations.

Only sporadic actual measurements have been made the main reason being the lack (and high cost) of the analysis capacity.

2.3.6. SUMMARY OF FUTURE PRODUCTION, USE AND RELEASES OF POPS – REQUIREMENTS FOR EXEMPTIONS

Sudan is not aiming to re-introduce any POPs pesticides. The existing obsolete stocks of approximately 234 tons are stored and for which is actively seeking solutions to destroy these substances.
PCB is being used as a dielectric in the old transformers. The estimated quantity of PCB in liquid phase (stored at the NEC's

premises) is some 8 tons while the quantity of PCB and PCB contaminated dielectric in the equipment are 246,3 and 32,5 tons, respectively. The quantity of PCB used in (old) transformers is decreasing, but no abrupt stop or ban is envisaged. All the new equipment NEC is introducing are non-PCB. A detailed phase-out (and destruction) plan for the existing quantities will be developed by NEC in the near future. It is very likely that elimination of the PCB substance as well as the phasing-out of the contaminated equipment will take place within the time limits set in the Stockholm Convention.

DDT has not been used in Sudan since 1998 for malaria/vector control purposes and the country has no stocks for these purposes. However, the vector resistance and other factors affecting the spreading of malaria are difficult to control or forecast. Therefore, Sudan will opt to include DDT in the register of exemptions. The re-introduction of DDT, which is not likely, will take place within the WHO frame and according to the recommended guidelines.

The volumes of the unintentional production of PCDD/PCDF, HCB and PCBs are extremely difficult to foresee. The current release/emission sources inventoried are not yet studied in detail. The rapid economic development and increase of the production goods and material consumption tends to result in larger emissions. The following paragraphs elaborate on the possible trends of the release/emission development by source categories:

Waste incineration accounts for 0.02 % (g 0.203 TEQ) of the current UPOPs releases. It is likely that the release volumes increase modestly along with the increasing waste volumes.

Ferrous and non-ferrous metal production accounts for 0.68 % (g 6.712 TEQ) of the current UPOPs releases. The production of metals and especially the reprocessing of scrap metals will most likely increase, which tend to increase the emissions. However, the current and future releases could be reduced with rather simple and inexpensive measures.

Power generation and heating makes currently 2.43 % of the total UPOPs releases (g 24,133 TEQ). The power generation capacity is increasing, which tends to increase the releases. However, most of the releases in this source category are from the domestic heating and cooking with biomass (wood, charcoal, waste). The releases

tend to increase with the population growth. However, increasing electricity, gas, and solar power as domestic energy sources tend to decrease the releases from biomes.

Production of mineral products makes 0.02 % (0.214 g TEQ) of the total UPOPs releases. It is likely that all these industries are increasing their production and, consequently, the releases tend to increase unless new, cleaner technologies are adopted.

Transportation counts for 0.02 % (g 0.178 TEQ) of the UPOPs releases. The number of cars is rapidly increasing and the improving motor/engine technology cannot counterbalance the trend of increasing releases.

Uncontrolled combustion processes make the huge majority, more than 94 % (g 933,249 TEQ) of the total UPOPs releases in Sudan. Future releases are extremely difficult to foresee. One can assume that e.g. forest fires, burning of agricultural residues and releases from accidental fires are not increasing while the uncontrolled domestic (municipal) waste burning, which alone counts for more than 80 % (g 802,455 TEQ) of all UPOPs releases in Sudan, is very difficult to reduce due to the increasing consumption of all type of consumer goods, which trend is inevitable with the improving economic situation in the country. The developing waste management and emerging waste separation practices are counterbalancing this upward trend.

Production of chemicals and consumer goods counts for 2.42 % (g 23.992 TEQ) of the total UPOPs releases. The production is increasing thus tending to increase the releases. Several industries in this sector have good opportunities to reduce the releases through improved technologies and cleaner production measures.

Waste disposal at the landfills counts for 0.29 % (g 2.900 TEQ) of the UPOPs releases. Sudan has only few managed landfills, the number of which is, however, increasing which obviously means increasing releases but still larger reductions in UPOPs production from uncontrolled burning of waste.

2.3.7. EXISTING PROGRAMMES AND FINDNDINGS FOR MONITORING RELEASES, ENVIRONMENTAL AND HUMAN HEALTH IMPACTS, INCLUDING FINDINGS AND IMPACTS ON ENVIRONMENTED …….[10]

The pesticide residues has been closely monitored in Sudan since 1970s, which resulted in banning, for more that 25 years ago, some of the pesticides (DDT, Toxaphene, Endrin) currently known as POPS pesticides. This ban was supported by extensive agricultural research in Sudan, which research has its roots in the beginning of 1900s, more than one hundred years back.

Regarding the POPs, as known today and as defined in the Stockholm Convention, no systematic, comprehensive monitoring or impact follow-up program exists at this stage of the Convention implementation. However certain institutions are currently involved on management of certain groups of chemicals including some POPs. Table (2.13) enumerates the relevant institutions and briefly describes their research areas/specialties

[10]) The contents of this chapter is largely based on the HCENR report "Assessment of National POPs Monitoring and Research and Development (R & D) Capacity for Persistent Organic Pollutants (POPs) in the Sudan" by Dr. Azhari Omer Abdelbagi. Khartoum 2005.

Table 2.13 Institutions Involved in Chemical analysis and could Potentially be Involved on POPs research.

Name/Description of Institution	Speciality
Agriculture Research and Technology Corporation (ARTC)/ Ministry of Science and Technology.	Analysis of pesticide formulations; Analysis of pesticide residues in supervised trials; Research on pesticides; Training on pesticides; Surveillance for pesticide susceptibility and resistance, Integrated pest management.
University of Khartoum, Faculty of Agriculture, Faculty of Science, Institute of Environmental Studies.	Teaching at both graduate and undergraduate levels; Training; and Research on pesticides and other environmental pollutants.
University of Gezira, Faculty of Agricultural Sciences	Teaching at both graduate and undergraduate levels; Training; and Research on pesticides and other environmental pollutants.
Other Universities	Teaching at both graduate and undergraduate level, Research and Training.
Food Processing and Research Centre, (ARTC), Ministry of Science and Technology	Testing of samples of food & starting materials; Research in food processing.
Industrial Consultancy & Research Centre, Ministry of Science and Technology	Analysis and research related to food science; Testing physical and mechanical properties of several industrial products; Feasibility studies.
National Centre for Research, Ministry of Science and Technology	Analysis of ingredients of medicinal and toxic plants; analysis of environmental chemicals with special reference to water and soil contaminants. Studies on tropical endemic diseases (malaria).

Name/Description of Institution	Speciality
National Chemical Laboratories, Ministry of Health (MOH)	Analysis of Food and Feed & water for Quality control and their fitness for human consumption; Study and analysis of food products for registration; Analysis of Toxic chemicals and contaminants; Research and surveys; and Training.
Sudanese Standards & Metrology Organization	Analysis of exported and imported products for compliance with specifications; Research, supervision; and Training.
Central Petroleum Laboratories (CPL), Ministry of Energy and Mining	Analysis of crude oil and petroleum products, water, and environmental sample for quality control and other purposes as required; Analysis of core samples, reservoirs fluids…etc.; Geological and geochemistry analysis; and Training.
Forensic Science Laboratory, Ministry of Interior	Analysis of chemicals causing poisoning in homicidal, suicidal and accidental cases; On-job training.
National Medical Laboratory, Ministry of Health	Analysis of biomedical samples; Research; Training; and Supervision on private medical laboratories; Evaluation of public health pesticides for registration purposes; Monitoring of susceptibility and resistance to pesticides.
National Malaria Administration, Ministry of Health	Monitoring of vector susceptibility and/or resistance; Research and Training on IVM methods and DDT alternatives.

Name/Description of Institution	Speciality
Occupational Health Laboratory	Determine the levels of toxic pollutants in the work place and environment & their adverse health effects; Survey; Research; and Training.
Customs Laboratories	Testing of samples for tariff classification and control of goods and narcotics in entry ports (sea, air.. etc).
Geological Research Laboratory	Hard rock analysis; Minerals studies.
Quality Control laboratory, Ministry of Electricity	Quality control aspects of water, petroleum products and lubricants; Training.

There is a great variability in human resources and technical infrastructure available in the above mentioned institutions. A common feature is rather non existent and out of order equipment and lack of internationally recognized protocols, references and standards. Some institutes/laboratories apply e.g. ISO standards. Some laboratories, like the National Chemical Laboratories, are used to improve the work quality by participating in inter-laboratory collaborative programmes such as the WHO/UNEP Global Water Quality Monitoring Programme.

Currently Sudan, as most of the African countries, has no capacity to analyse in detail dioxins, furans and e.g. PCB with accuracy, which would be relevant in interpreting the results in a reliable and proactive way.

2.3.8. CURRENT LEVEL OF INFORMATION, AWARENESS AND EDUCATION.

The POPs issue is new in Sudan as well as in most other countries. The hazards of POP pesticides and especially the DDT has been known more than 20 years ago, but this knowledge and information about the adverse impacts on the ecosystems and humans has been limited within the experts and the concerned academic circles. The general public, e.g. people living in the vicinity of the pollution/emission sources, are hardly aware of the risks.

The PCB issue, i.e. the risks related to the handling of PCB and PCB containing equipment has been completely unknown among the concerned NEC staff even though there are few individuals aware of the risks.

Regarding the unintentional production of POPs from waste and biomass burning, the general public is not aware of the specific risks. However, the general public understands that smoke, dust and emissions of particulate matter into the air in many processes is a nuisance, harmful for human health. There has been local information campaigns, newspaper articles etc. addressing those issues, but hardly from the point of view, which points out the long-term risks, the carcinogenic aspects of the emissions etc.

The Khartoum State Waste Management Corporation has produced brochures aimed at the general public instructing people to initiate good practices in the waste collection from the household and local community level.

Since signing the Stockholm Convention in 2001 the Government and especially HCENR has made efforts to give the POPs issue publicity among the general public but also among the decision-makers.

The Plant Protection Directorate of the Ministry of Agriculture and Forestry held in 2005 a large seminar, attended by the National Assembly members. The seminar covered the whole chemical management issue in Sudan, including the Stockholm Convention. Moreover, lately (in 2004-2006) and in support of the ratification of the Stockholm convention, HCENR secretary general, NIP coordinator and NIP technical adviser have presented the Stockholm Convention to the National Assembly Committee for Environment and Tourism.

The large Multi-Stakeholder National Coordination Committee (MNCC) has been an essential information dissemination media regarding the POPs since its establishment in the beginning of 2004.

One should note that the Environment Protection Act of 2000, even though it is general framework, points to the necessity of raising the standard of the public awareness on the environmental issues. Furthermore, the Act calls for introducing the environmental issues in the school curricula. Even though the specific POPs issue is hardly

addressed at schools, the general environmental awareness raising supports the mitigation activities.

Since the signing of the Stockholm Convention, Sudan has actively participated in the international cooperation regarding the implementation of the convention. Sudan is an active member in the Eastern Mediterranean Network (within the WHO) to develop and coordinate the vector control efforts and is able to benefit from the joint information generated within this network and within WHO in general.

Furthermore, Sudan is actively participating in the Regional Organisation for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA), which organization is relevant regarding the Eastern part of Sudan facing the Red Sea but also an important information exchange forum.

2.3.9. RELEVENT ROLE AND ACTIVITIES OF NGO STAKEHOLDERS

Non-Governmental Organizations (NGOs) focus on activities which are not usually covered by governmental agencies due to lack of fund, irregular organisation and the instability of the working conditions. In general, the environmental protection is an issue, where the NGOs have found place for completing the activities of the government and other official organisations. The NGOs serve positively in the dissemination of information and awareness when being close to everyday practical life of the people.

Sudan has some 150 active NGO's and the number being in steady increase recently. Out of these organisations some 20-30 are directly involved in the environment related activities even though most of them may have a very specific agenda and narrow goals. Apart from the environmental issues some NGOs are only working on community development e.g. promoting the well-being of families, women and children where they are very instrumental in the information dissemination regarding the risks. There are also introducing better and acceptable practices (e.g. in domestic cooking).

The Sudanese Environment Conservation Society, Sudanese Chambers of Industries Association and the Sudanese Agro-Chemical Association (SAGA) have participated in the development

of this National Implementation Plan. It is expected that these three groups not only support the government in developing the POPs related policy but that they will be instrumental in the implementation and promotion of the new practices and mitigating the adverse impacts of the old ones within their respective interest spheres.

2.3.10. OVERVIEW OF TECHNICAL INFRASTRUCTURE FOR POPS ASSESSMENT, MEASUREMENT, ANALYSIS, ALTERNATIVES AND PREVENTION MEASURES, MANAGEMENT, RESEARCH AND DEVELOPMENT – LINKAGE TO INTERNATIONAL PROGRAMMES AND PROJECTS

Sudan has currently no technical infrastructure for the assessment, measures and detailed analysis for some POPs. The most advanced knowledge, in respect of POPs, is related to the pesticides and there is some laboratory capacity.

Regarding management, research and development reference is made to the chapter 2.3.7 above, which elaborates on the current status and programmes of institutions and organizations with a potential to contribute in the POPs issue.

Sudan has no capacity to dispose the existing POPs waste except that there is a small (experimental) hospital waste incinerator and efforts to neutralize hospital waste by a chemical process.

At this stage the actual linkages to international programmes, when it comes to the practical, operational activities, are not available, but the stakeholders, especially HCENR, are actively collecting information from external POPs related mitigation and phase-out programmes and technologies.

2.3.11. IDENTIFICATION OF IMPACTED POPULATIONS AND ENVIRONMENTS, ESTIMATED SCALE AND MAGNITUDE OF THREATS TO PUBLIC HEALTH AND ENVIRONMENTAL QUALITY[11]

The adverse impacts of the POPs has been briefly discussed in chapters 2.3.1 (pesticides), 2.3.2.(PCB), 2.3.3. (DDT) and 2.3.4. (Unintentional production) earlier in this report. There is no comprehensive assessment of the impact of POPs on human and

[11]) The data and information in this chapter is largely based on the HCENR "Levels of POPs chemicals in the Environment and Human exposure", by Dr. Azhari Omer Abdelbagi. Khartoum 2005.

ecosystems in Sudan. This is mainly because the POPs issue is a very new item in the environmental agenda. Secondly, the accurate knowledge, observations and measurements are missing. Sudan, like most African countries, doesn't have any advanced analytical equipment to measure the occurrence or the concentration of some of the regulated substances in humans or ecosystems. The HCENR has committed one expert to compile a summary of the existing studies and reports regarding the impacts of POPs.

2.3.11.1. POPs Occurrence in the Environment

There are no extensive studies covering the POPS occurrence in the abiotic components of the environment (air, water, marine water, and river and lake sediments, in marine sediments and in soil). The Sub-Saharan regional report by UNEP[12] refers to some occasional studies and survey results in Sudan as follows:

*Chlordane in rain water

In the first instance air is the main POPs polluted environmental media, but it is further obvious that most of the POPs in the residues (ash e.g.) very soon transgress into soils, and partially to the air. Thus the contaminated soil most likely presents the worst polluted environmental media in Sudan. However, it should be pointed out that little is known of the transgression of the substances from one media to the other. Further, the process of transgression from abiotic media to biotic media (and thus to the humans) is difficult to trace.

The occurrence of POPS in the biotic media, plants and animals is also not well studied. Eltom (1997)[13] analysed 50 samples of cow's milk from a village (Fadasi) in the central Sudan and found 0.12 µg/g of Lindane, 0.01 ng/g of aldrin, 1.28 ng/g of heptachlor epoxide and 1.75 ng/g of DDE.

El-Zorgani and Ali (1981) found that all fish tissue samples collected from different areas of the Sudan contained DDT residues. The concentration in the muscles and liver ranged between 0.04 and 0.2 µg/g. Fat samples contained higher levels, ranging from 0.3 - 3.3 µg/g.

[12] UNEP, Regionally Based Assessment of Persistent Toxic Substances. Sub-Saharan Regional Report. December 2002.

[13] Eltom, M. (1997). MSc. Theais, University of Gezera.

The finfish of Lake Victoria (Kenya) was studied in the years 1990 and 1992. The levels obtained were 7 - 70 ng/g for dieldrin, 1 - 47 ng/g for Lindane, 20 ng/g for aldrin, 3 - 460 ng/g for DDT and 20 - 332 ng/g for PCBs. It should be noted that Lake Victoria feeds the river Nile that in turn feeds Lake Nubia.

Table (2.14) summarises the findings and studies regarding the POPs levels in the Sudanese environment.

Table 2.14 Summary of the levels /range in ppb of POPs in the Sudanese environmental media

Media	**Intentional POPs pesticides**					**Unintentional POPs (dioxins, furans & PCBs)**
	DDT or metabolites	**Heptachlor or heptachlor epoxide**	**Aldrin**	**Dieldrin**	**HCH**	
Soil	ND-5530	ND-1000	ND-560	ND-2.21	ND-20	NDA
Surface water	0.01-4.05	0.04-5.5	0.02-0.05		ND	NDA
Ground water	ND	ND	ND	ND	ND	NDA
Marine water	ND-350	ND-4500	NDA	NDA	ND	NDA
Sea sediments	ND	ND	NDA	NDA	ND	NDA
Air	NDA	NDA	NDA	NDA	NDA	NDA
Fishes	270-16000	NDA	NDA	NDA	NDA	NDA
Birds	50-5560	NDA	NDA	70-5500		NDA
Cotton seeds	20-4000	NDA	NDA	NDA	NDA	NDA
Sorghum	3-120	NDA	NDA	NDA	NDA	NDA
Wheat	20-2160	NDA	NDA	NDA	NDA	NDA

Media	Intentional POPs pesticides					Unintentional POPs (dioxins, furans & PCBs)
	DDT or metabolites	Heptachlor or heptachlor epoxide	Aldrin	Dieldrin	HCH	
Fruits &vegetables	ND-70	NDA	NDA	NDA	NDA	NDA
Animal milk	10-109000	30-1280	10-30	ND-120		NDA
Animal fat	470-1210	ND	ND	ND		NDA
Human milk	8-71830	40-3250	2-470		2-480	NDA
Human blood (occupationally exposed)	10-2010	1280 (average)	10 (average)	10-384	34-120	NDA
Human blood (random population)	4-618	1-170	NDA	ND-82	ND-92	NDA

NDA = No data available ND = Not detected

2.3.11.2. Evaluation of the exposure of Sudanese population to POPs

Only few studies have been carried out regarding the impact of POP chemicals. Liedholm and Amisi reported that already in 1977, lindane, DDT and dieldrin concentrations of 0.4, 10. and 1.0 ng/g, respectively, are found in human blood in some rural areas. The concentration of certain pesticides in human blood has been sample wise analysed in some typical agricultural areas (table 2.15). These analyses can hardly be considered indicative for reaching conclusion due to lack of comparison and reference data. The residues of certain pesticides in the soil in typical agricultural areas has also been sampled and analysed. The lack of time series and lack of

reference data doesn't allow any conclusions but the data, however, can be utilised in the forthcoming follow-up.

People working in Plant Protection Directorate, Wad Medani, Sudan were occupationally exposed to insecticides, either by selling, mixing or spraying. OCs were shown to affect the biochemistry of mammalian systems in various ways. The problem is mainly their chronic effects. The results obtained from the blood serum of occupationally exposed people were as follows: DDE was found in all samples with a range of 0.02 to 0.72 ng/ml whole blood; p,p-DDT was detected in seven samples out of 24 (0.01-0.18); o,p'-DDT & TDE were also detected(0.01-0.4& 0.02-0.2 µg/ml, respectively. HCH was detected in 11 samples (0.07-0.15 ng/ml whole blood). The occurrence of aldrin & dieldrin was less frequent; their concentrations were lower than 0.03 µg/ml. There is correlation between DDE level in the whole blood & adipose tissue. DDT in the blood indicated very recent exposure, whereas DDE reflected the chronic level of DDT exposure. One year was required for the metabolism of DDT into DDE,. Eltom (1997) studied 50 blood samples from one village in central Sudan. HCH, aldrin, heptachlor epoxide and DDE were detected at the levels of 0.12 ppm, 0.01 ppm, 1.28 ppm and 1.75 ppm, respectively.

Table 2.15 Concentration of POP pesticide residues (ppb) in human blood samples collected from different agricultural sectors in the Sudan during 1998

Area	Average Concentration and Range (ppb)				
	No. of samples analyzed	HCH	Heptac-hlor	DDE	Dieldrin
Irrigated cotton schemes	67	23.55 (0-92)	60.21 (8-111)	163.41 (30-380)	13.46 (0-58)
Irrigated sugar schemes	29	6.55 (0-22)	65.72 (28-93)	100.06 (21-167)	31.72 (10-82)
Riverine areas	40	7.04 (0-44)	11.89 (1.29-36)	31.55 (9-77)	4.65 (1.11-19)

Area	Average Concentration and Range (ppb)				
	No. of samples analyzed	**HCH**	**Heptac-hlor**	**DDE**	**Dieldrin**
Mechanized rain-fed areas	20	4.99 (0-29)	14.4 (2.29-82)	31.28 (3.8-174)	4.44 (0-11)
Traditional rain-fed areas	39	14.6 (0-36)	12.47 1.72-31	35.22 (12.8-87)	5.54 0-18
Grand average		11.346	32.938	72.304	11.962
Sample tested +ve %		86.15	100.0	100.0	98.64

The number of people exposed to the pesticides contaminated containers and contaminated soil is difficult to assess. It is obvious that the people working at the currently operational pesticide stores are exposed to the highest risk. If one assumes that some 5-7 people are at least occasionally working in the stores, the total number of individuals at immediate risk are about 1500- 2000. Obviously, store locations near settlements and water channels are the most risky.

One can naturally assume that there is a direct correlation between the existing pesticide quantities and human exposure and risks.

Regarding the human exposure to PCB the risks are concentrated, naturally, in the areas where the electricity network exists, i.e. in the central parts of the country and in the urban areas. Out of the total dielectric fluids in the transformers 12,8 % is PCB contaminated. The weight of disposed/ stored dielectric liquid, which may contain PCB, is some eight (8) tons. The NEC has hardly any experience in the environmentally sound management of contaminated liquids or equipment. However, the present preliminary inventory has formed an extensive database, which will support the NEC in the further management and proper disposal of the equipment and liquids.

Some 1500 employees of NEC (out of 7200) participate in the maintenance of transformers and equipment, which contains or may contain PCB.

Two thirds of the transformers are located in the urban densely populated areas. Naturally, these transformers are in the vicinity of residential and commercial areas and hence present a higher risk to humans than the transformers in less densely populated areas. However, the technical conditions of the equipment vary and one cannot claim that the transformers in urban areas pose some specific risks.

The distribution of transformers by area type could be listed as follows

Urban	67.0 %
Industrial	22.3 %
Rural	8.9 %
Suburban	1.8 %

The transformer/PCB survey data doesn't allow a detailed assessment of the equipment associated with the production or processing of food and feed.

The annual unintentional production and releases of dioxins and furans are estimated at 991.6 g TEQ. Air, as a media counts for 38% of the estimated releases. Air is expected to carry these substances long distances and is thus difficult to assess. The inventory concluded that dioxin and furan are not released to water since they are water insoluble but it is clear that water, rains and surface water streams can carry dust/soil residues containing dioxins and furans. Soil as a media containing 5% of the released dioxins and furans is usually stable in the sense that it doesn't move and consequently substances in it may not move. However, little is known about the interface of surface water/oil and air (winds and storms)/soil and how these affect the movements.

The uncontrolled combustion processes are the largest sources of dioxin and furan releases, counting for approximately 95 % or the total releases. Almost all of these releases come from the burning of domestic waste (including waste from commercial establishment and small industries). Waste burning is a problem of mainly urban areas and one can say that almost all urban population, more than 10 million people are exposed to the releases/emissions from the burning of waste, directly through the smoke and then from the residues, which transgress to environmental media.

Power generation and heating is the second largest release source and in practice all these releases are from the biomass burning for domestic cooking and heating. The power generation and heating in the industrial sector takes place mainly in sugar industry and brick industry while steel industry, thermal wire reclamation and tanneries generate POPs in the production process itself. Almost all people are exposed to the release and emissions from biomass burning, excluding the people living in the central urban areas where electricity and gas are used for domestic cooking and heating.

A specific mothers' milk survey to detect the existence of POPs, especially dioxins and furans, in the milk of lactating mothers has been initiated in March 2006. The results of this survey are not available when this implementation plan is being compiled.

2.3.12. ASSESSMENT AND LISTING NEW CHEMICALS

Apart from pesticides, there are no general laws or regulations in force in Sudan to assess and list new chemicals. The pesticide substances (or in general the agro-chemicals) are reviewed and regulated as described in chapter 2.3.1.3. above. The environmental protection act of 2000 refers to the adverse effects of chemicals but does not establish any specific pre-screening procedures. Regulations on public health chemicals and occupational safety basically mandate the authorities to screen the impacts especially the adverse impacts of these chemicals.

Regarding some specific chemicals like refrigerants and other chemicals regulated under the Montreal Protocol, Sudan has established an effective pre-screening system to monitor the substances entering into the market. Basically this type of pre-screening system can be adopted to cover other toxic chemicals, including POPs.

3. STRATEGIES AND ELEMENTS OF ACTION PLANS OF THE NIP

3.1. POLICY STATEMENT

The Government of Sudan has ratified the Stockholm Convention, Basel and Rotterdam conventions and is prepared to do its share to manage, phase-out and eliminate the chemicals now regulated and substances to be regulated in the future following the international agreements, conventions and practices considered suitable and applicable in the conditions of Sudan.

Further the Government of Sudan will note that the management and phasing out of the Persistent Organic Pollutants, within the framework of the Stockholm Convention and beyond it, requires international and regional cooperation, in which the Sudan is actively participating.

The use of the pesticides and PCB are largely based on research and technology conducted by developed, industrial countries. Sudan has had very modest opportunities to participate and contribute to this development in the past and considers, therefore, that the adverse effects of these substances should be mitigated with the support of those countries which directly and indirectly have benefited from the introduction of these chemicals. Sudan has never produced POP chemicals (even though allowed commercial formulation to be done in the country) and is no more importing or using the regulated pesticides. The possible application of DDT is being run within the framework of WHO in the regional context and the adverse effects of DDT are being controlled. Sudan naturally recognizes its role in this development and will behave in a responsible and contributive way as a member of the international community.

The unintentional production of dioxins and furans in Sudan is very much related to the economic development and the practices of burning the agricultural residues, waste and wood. Dioxins and furans are one of the largest health hazards. However, the new energy sources are one alternative to reduce the production of dioxins and furans, or at least reduce the future growth. Sudan sees that the introduction of the new LPG utilizing technology deserves international support and wishes to point out that the whole African continent could benefit from the new opportunities to use LPG introducing new technology available in developed industrial countries.

Further Sudan aims to apply the Polluter Pays Principle (PPP) when mitigating the POPs generated problems. This principle would make a more direct link between the roots and causes and the corresponding financial phase-out costs. However, taking into consideration that the economic structure in the country is rapidly changing the PPP has limited opportunities regarding the problems from the past, but the PPP is to be incorporated in the further new activities.

Sudan is continuously revising and updating its regulatory framework regarding the environmental issues and environmental management. The POPs management, phase-out and elimination issues are being integrated in the climate change policy as appropriate, in general in the framework of the management of chemicals and, increasingly in the industrial regulations and waste management.

The Government has reviewed the National Implementation Plan for POPs reduction and/or Elimination submitted, by the Higher Council for the Environment and Natural Resources and will adopt it and is committed to undertake adequate activities in order to comply with the tasks included in the NIP action plans and meet the Stockholm Convention provisions at the same time:

3.2. IMPLEMENTATION STRATEGY

This implementation strategy serves as a road-map; how to reach the objectives set in the Stockholm convention. The main elements of the strategy, from the Sudanese perspective, are as follows:

* Sudan is prepared to eliminate the use of the eight pesticides mentioned in Annex A; In practice this objective means that Sudan will not allow the re-use or re-introduction of these substances, which are no more used and, further, will actively seek cooperation and means to manage and eliminate there existing obsolete stocks. The pesticide strategy is supported by a concrete action plan.
* Sudan will identify, label and remove from use the equipment using polychlorinated biphenyls (PCB) and make efforts to reduce the possible exposures and to control risks as far as the equipment containing PCB is still in use. Further, Sudan will make efforts to manage and treat the PCB containing equipment and PCB as substance by the agreed deadlines of 2025 and 2028, respectively. An accelerated phase-out of PCB is sought.

The PCB elimination strategy is supported by a concrete action plan.

* Sudan will restrict the application of DDT in disease vector control when in utmost need only, if ever, and apply it in accordance with the World Health Organization recommendations. However, Sudan will actively continue the national research work on alternative methods and substances to replace DDT. To avoid the risks, however, Sudan will seek an entry to the DDT in the register of exemptions as established by the Stockholm Convention. However, Sudan is aware that entry to the register is a temporary action that doesn't replace the efforts to phase-out and eliminate the use of DDT.

- Sudan will identify the known and assumed sources of the production of dioxins and furans and will further put extensive efforts and other resources to reduce the unintentional production by adopting the Best Available Technologies (BAT) and the Best Environmental Practices (BEP). The strategy is supported by concrete action plans covering the most important and critical emission sources.

3.2.1 Operational Objectives

The implementation strategy consists of five major parts covering the actual, operational objectives in the management, phase-out and elimination of POPs; the five parts are:

a) Development and setting up the necessary legal and administrative framework including the awareness raising within the stakeholders, non-sector specific support activities such as information exchange, monitoring and reporting mainly to inform the international community and the parties of the Stockholm Convention to keep Sudan in the page of the development.

b) Management of POPpesticides and their obsolete stocks,

c) Management of unintentional production of dioxins and furans,

d) The management and elimination of PCB, and

e) Management and/or elimination (as appropriate) of DDT in vector control.

The overall strategy to reach the objectives established above will be a combination of several measures including direct government involvement (regulations and law enforcement efforts), support to the local actors, direct market instruments like possible subventions and tax-breaks, seeking international cooperation and co-funding. An

essential part of the POPs management and phase-out efforts is the extensive regional and international cooperation regarding both the impacts assessment as well as the management and phase-out measures, both regulatory and technical.

The major, tangible implementation strategies are supported by action plans and largely quantified programmes and projects while some POPs areas still need further elaboration within the opted strategy before being tuned into more tangible actions and projects. Further, the important support activities like monitoring, reporting and POPs related research and development are also dealt with.

3.2.2 Priorities

The overall strategy is based on national priorities, which have been set, based on consultations and other discussions involving all the relevant stakeholders. Before setting these priorities the NIP compilation process made efforts to provide all stakeholders with complete information regarding the current status, the known facts and the estimated impacts using legal and regulatory requirements, estimated and/or known environmental and ecological impacts, human exposure and urgency as priority criteria. The MNCC arranged two specific sessions discussing the priorities[14]. This was to guarantee that the priority setting is not only an expression of an interest group policy but a balanced view representing the whole community and thus covering the purposes expressed in the Article 3 of the Stockholm Convention: “Protect human health and the environment by taking the necessary measures to minimize or prevent releases; in the *Article 7: Implementation plans; …consult national stakeholders, including women’s groups and groups involved in the health of children; Article 10: Public information, awareness and education; Awareness among its policy and decision makers...; Provision to the public all available information …especially for women, children and the least educated…; Public participation, public access to information; *Article 11; Research, development and monitoring; …effects on human health and environment, socio-economic and cultural aspects…effects on reproductive health and in *Annex A, Elimination, measures to reduce (PCBs); ..use only in intact and non-leaking equipment and only in areas, where the risk …can be minimised and…

[13]) The priority setting is explained in detail in a separate report: “HCENR, Priority Assessment. August 2005.”

remedied…When used in populated areas, including schools and hospitals, all reasonable measures to protect…Further the set priorities aim to express also realistic implementation opportunities.

The first session discussed the priority issue and criteria in detail. At the end of the session each individual member of the MNCC assessed the priority of each POPs problem category (pesticides, PCB, DDT, and dioxin and furans by source category) by giving her/his qualified opinion and priority order. The second session discussed the results of the preliminary priority order and then formed the comprehensive view trying to balance all the sector wise and specific concerns.

The priorities, presenting the current knowledge and balanced view are as follows:

First Priority the management and proper disposal of obsolete pesticide stocks (together with the contaminated soils surrounding the pesticide storages and the contaminated pesticide containers) and the uncontrolled combustion (mainly waste burning including hazardous wastes) make the first priority of the activities needed to tackle the POPs issue.

Second priority group consists of measures to manage dioxin and furan releases from waste incineration, power generation and heating (e.g. biomass/wood burning for domestic purposes,) from the production of chemical and consumer goods and from the production of mineral products.

Third priority covers the management and phase-out of PCB in transformers and capacitors and DDT in malaria control, waste disposal at landfills and transportation.

The abovementioned priority order makes the baseline in the sequence of the proposed actions and the Government of Sudan is applying this order whenever appropriate and expects that the external parties supporting the implementation also follow the said order.

The Stockholm Convention doesn't set any specific time frames in the restriction and elimination of the controlled POPs except that the PCB contaminated equipment containing liquid stocks should be identified, labelled and removed from use by 2025 and that PCB as liquid is managed (in practice destructed) in an environmentally

sound manner by 2028. Sudan notes that the above mentioned deadlines are subject to the review by the conference of the parties and that earlier phase-out and elimination measures may be not only environmentally but also economically reasonable.

The implementation of POPs management and phase-out in Sudan is scheduled to start, in the mode as stipulated in the Stockholm Convention, immediately. The preliminary target being that the tangible, concrete measures will take place within 2007-2010 after which time period the POPs management will be turned into a more routine best environmental practices supported by regulatory framework, monitoring and research and development.

3.2.3 Time schedule

Figure: 3.1. Summarises the overall time schedule for the National Implementation Plan for managing and phasing out of POPs in Sudan.

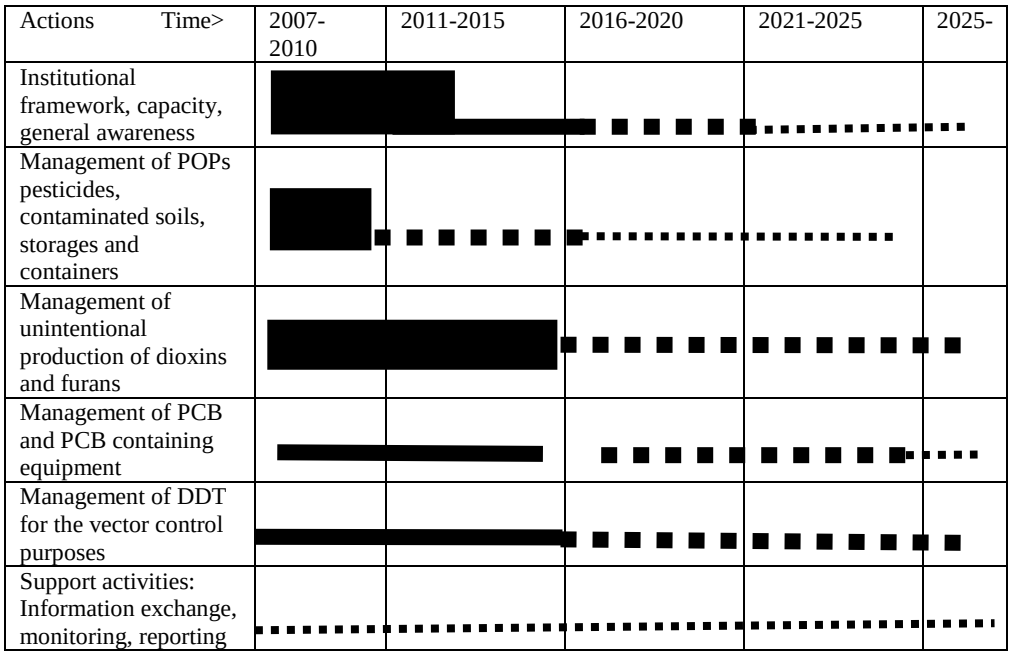

Figure: 3.1. Overall time schedule for the National Implementation Plan

3.2.4 Coordination

The POPs are scattered over several economic sectors as well as over a very wide geographical context in Sudan. The strategy is, however, to keep all the efforts coordinated and monitored by one institution within the Government, i.e. by the Higher Council for Environment and Natural Resources (HCENR) but leave enough space and resources for the sectors involved to guarantee a smooth and non-frictional work.

The existing coordination unit does not have further mandate to coordinate the implementation of the NIP. However as indicated in section 3.3.1 HCENR capacity should be strengthened to establish specific POPs project to safeguard the utilization of results already achieved and to serve as a coordinating body within the government and, as appropriate, within other agencies. Hence HCENR will be the lead agency in the implementation of the NIP with the following TOR:

1. Undertake regular monitoring and evaluation of the NIP implementation.
2. Update the NIP after a period of five years or earlier if the prevailing political situation in the country necessitates so.
3. Coordinate the execution of action plans.
4. Facilitate fund raising for the project proposals in the present NIP.
5. Facilitate information exchange with General Secretariat of the convention and the other relevant agencies.
6. Act as a national focal point for all information database and dissemination pertinent to POPs.
7. Create linkages with international agencies to gain technical support and any recent advancement in the POPs issues.

3.2.5 Monitoring and Evaluation

The Monitoring and Evaluation of the NIP implementation will be undertaken by HCENR and the funding agencies, national and / or international through consensus workshops. The purpose of Monitoring and Evaluation process is to measure the impacts of the activities on the set goals of the action plans to see how much achievement in the elimination of POPs has been reached.

3.2.6 NIP updating & reporting

HCENR will report to Stockholm Convention Secretariat on regular bases, or as required by the secretariat. Updating will be every five years or as the political situation dictates.

3.3. SECTORAL STRATEGIES AND ACTION PLANS

3.3.1 STRENGTHENING OF STOCKHOLM CONVENTION FOCAL POINT (HCENR)

Sudan initiated the POPs management issue by setting the Higher Council for Environment and Natural Resources (HCENR) as the national focal point to implement the Stockholm Convention and the Convention related formal and administrative activities. A special Enabling activity project was established in the beginning of 2004, which project framed POPs issue in Sudan extensively as described earlier in chapters 1 and 2 in this report. The project has preliminarily quantified the POPs, their location, emissions and assessed the adverse impact on the population and the different ecosystems. Also the project has created an extensive contact network and identified all relevant stakeholders regarding further actions. A national as well as an international expert network and data/knowledge base has been created. This initial exercise has been very encouraging and has delivered background information, information of envisaged solutions and also framed the economic and financial context as well as approximated resource needs

Even though, in the future, the POPs related mitigation, management and phase-out activities gradually turn to sector-specific actions and programs. It is highly recommendable that the implementation process remains within one organization, i.e. HCENR which will not only manage the Convention related formalities but manage the overall POPs issue, coordinate and balance the efforts and monitor the progress. The implementation involves extensive cooperation with the external partners, the co-financiers and the donors. Separate technical projects, interventions and their implementations, even though requiring specific technical and scientific skills as well as introducing new industrial practices should all be reviewed from the Stockholm Convention point of view, too.

Regarding the POPs issue general awareness raising is important, but the main awareness raising efforts will be specific and sector

wise. Further, it is envisaged that the current general Environment Protection Act of the year 2001 will cover the POPs issue and any new environmental concept whenever they may arise. HCENR is also the best place to serve as a formal focal point (involving monitoring and reporting) towards the Stockholm Convention. It is therefore proposed that the HCENR will establish a specific POPs project, to safeguard the utilization of the results already achieved, to serve as a guard within the government and, as appropriate, within other agencies.

This proposed project should last approximately five years securing the solid implementation of POPs related activities. It is estimated that within these five years the POPs management strategies will find its routine ways and the activity turns to more sector specific issues. The main responsibilities with the sector wise authorities and other actors, POPs related actions need monitoring rather than active involvement. The project should continue to maintain the already established institutional relationship through the Multi-stakeholder National Coordination Committee (MNCC), which has proved to be a very good sounding board in the POPs issue. The MNCC membership might be re-adjusted in the future to cover e.g. industries, businesses and special interests having an increasing role in the further implementation. It is essential that the roles and responsibilities of the governmental and semi-governmental bodies will be instituted, for a period of five years, by a higher governmental/political decision/act, which governs the MNCC work and provides it with the necessary powers and resources. Regarding the envisaged responsible organizations and bodies the membership should cover at least the following:

Representation in MNCC	Responsibility
HCENR	Overall coordination, budget and financing
Ministry of Health	Update and amendments of regulatory framework governing the waste management, active monitoring and supervision of all waste management related operations Review and update the occupational safety and health related regulations regarding the exposure of workers to the POPs. Support effort to identify and develop DDT alternatives for malaria control
Ministry of Industry	Enhancement and promotion of cleaner production in the industries, support to the introduction of new, cleaner technologies and, better practices, good housekeeping at industries and see the application of best available technology and best environmental practices in the new and existing establishment.
Ministry of Justice	Facilitation of the amended legislation
Ministry of Agriculture and Forestry	Updating of the pesticides related regulatory framework to include stricter rules regarding the handling of pesticides, Strong support to concentrate the obsolete pesticide stocks for final destruction, support to the pesticide related soil cleaning operations.
Ministry of Finance	Training of the Customs officers in the import/export of POPs chemicals. Secure (co-) financing and feasible finance related procedures
Civil society groups and NGOs	Public awareness and advocacy
Research institutions and universities	Research on impact (social and ecological), development of alternatives for POPs and enhancing phase-out of unintentional POPs production sources and awareness raising

The project requires, regarding the resources, one professional, 1-2 persons as support staff, part-time national consultants and budget for information exchange/gathering through participation in relevant international seminars and other occasions. It is obvious that the

HCENR can accommodate the activities regarding office space and other facilities.
The main activities of this project are-

- To strengthen HCENR capacity to act as a focal point for Stockholm Convention Implementation this include:
- Coordination of sectorial efforts and activities.
- Liase with international and regional related organizations.
- Seek funding from local regional and international organizations.
- Insure smooth and successful NIP implementation.

The budget for running the project for institutional strengthening for HCENR is estimated as USD 300,000.
(See project profile 1/28 annex 1)

3.3.2 STRATEGY AND ACTION PLANS TO MANAGE AND ELIMINATE POPS PESTICIDES AND MITIGATE THEIR ADVERSE IMPACTS.

Article 6 of the Stockholm Conventions states regarding the measures to reduce or eliminate releases from stockpiles and wastes the following:
1. In order to ensure that stockpiles consisting of or containing chemicals listed either in Annex A or Annex B (DDT) and wastes, including products and articles upon becoming wastes, consisting of, containing or contaminated with a 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 either 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 either 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 of Article 3, shall be deemed to be waste and shall be managed in accordance with subparagraph (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, and 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; and
(iv) Not transported across international boundaries without taking into account relevant international rules, standards and guidelines;
(e) Endeavour to develop appropriate strategies for identifying sites contaminated by chemicals listed in Annex A, B or C; if remediation of those sites is undertaken it shall be performed in an environmentally sound manner.

Annex A include substances (generally known as pesticides in this plan). The PCB (also included in Annex A) is handled separately. The quantity of obsolete POPs pesticide stocks is approximately 234 tons. In addition there are some 400 tons of contaminated seeds, which can be regarded as hazardous waste. The country has some 340 stores or storage sites containing obsolete stocks. At most sites the volumes of obsolete stock are small, but all storage sites present a soil pollution problem, the extent of which depends on several factors like the site location, technical condition of the stores and also on the management practices imposed while handling the pesticides. The contaminated soils, in the immediate vicinity of the stores is estimated at 8850 tons. This estimate is, however, very approximate and based on visual survey and other few simple parameters. In

addition to the obsolete stocks and contaminated soil the pesticide handling and transportation equipment, mainly drums and other packaging material, are contaminated. The quantity is estimated at 528 tons.

An additional difficulty regarding the pesticides and contaminated soil is that the largest quantities seem to be in remote areas, which are not within easy reach when it comes to interventions.

A more difficult and far reaching problem is the issue of the remains of the POPs pesticides in the environment. The application of POP pesticides from 1940s to 1980s, by aerial spaying and the relaxed transportation and handling and through the emission from storages by wind and floods etc. may have its effect on polluting the ecosystems. This has been only occasionally studied by sampling surface water, ground water, fish , animal and human tissues, milk and edibles. As far as DDT, it has been used beyond agriculture, for vector control, the possible remains are very difficult to quantify.

The overall strategy regarding the management of POPs and their adverse impacts covers the following: Additional local research (information collection, surveys, and details) on the current status to assess the extent of the problem and the actual extent of the impacts on the ecosystem and the people. Further, the current obsolete stocks, contaminated soils, contaminated equipment and containers should be carefully handled and managed to avoid any further spillage and spreading. The abovementioned improvements can be achieved through research, regulatory measures, training, improved management practices and making people aware of the immediate risks pertaining to being in touch, directly or indirectly and the current amounts and the items stored, contaminated, with these substances. Further, a system to observe and implement scientific limit values for the foodstuffs, soils used in building all public facilities etc. are important.

The second part of the POPs pesticide strategy covers more concrete actions. The available information allows concrete measures to be taken on the pesticide substances by collecting, containment, environmentally safe storage and final destruction (including the possibility of shipment outside Sudan). The same concerns applies for contaminated soil the shipment of which outside Sudan is obviously a less possible option. The strategy regarding the

contaminated containers (mainly drums) needs to be developed as part of the collection and transportation of the obsolete stocks and contaminated soils.

Based on the above strategy considerations the following four actions (3.3.2.1 – 3.3.24 .) are proposed.

3.3.2.1. Amendment of the Existing Legal Instruments and Strengthening Pesticides Law Enforcement

The current legal instruments of concern are: the Pesticides and Pest Control Products Act (1994), the Pharmacy and Poisons Act, the Environment Protection Act (2001) and the Environmental Health Act. These four acts were issued long before raising the issues of POPs and the international conventions covering them. Therefore, the existing laws must be reviewed, assessed and amended by legal teams, assisted by technical staff, to improve, remove any conflicts and update them to include the POPs management. Pesticide regulations should be made part of the environment policy. Moreover, the Sudan lacks adequate mechanisms and measures for protecting the public health and environment. The FAO issued the International Code of Conduct on the Distribution and Use of Pesticides which is the worldwide guidance document on pesticide management for all public and private entities engaged in pesticide management and use. This code should be accompanied as a norm in the legal framework.

The following activities are proposed to be included in this action:

- Formulating a legal team from the Ministry of Justice assisted by experts representing the NPC, the HCENR, MOH, MOAF, SECS and toxicologists from the universities and the research centres, to review and assess the existing legislations on POPs .
- Updating the existing acts and developing proper instruments for pesticides in general and POPs, in particular .
- Developing rules and regulations (including storage/stocking systems) for the management of pesticides.
- Develop legal requirements for environmental impact assessment of POP pesticides.
- Develop law enforcement mechanisms

(See project profile 2/28 annex 1)

3.3.2.2. Strengthening the Capacity to Handle POPs Pesticides and Contaminated Sites

Since the POP pesticides is a new issue, the people who are actively involved in the management of pesticides, contaminated containers and contaminated soils need an extensive training and skill development programme. Such programme, is very beneficial, instrumental and can actually introduce better practices at the operational level. The laboratory capabilities country-wide need upgrading. The protectionists as well as the pesticide sailors and retailers need some further training regarding the handling of POP pesticides.

Based on the above considerations the following activities are proposed:

Training plant protectionists and extensionists (training of trainers) to prepare them to train the farmers and the agrochemicals traders and sellers.

Upgrading the laboratory capacities in the relevant institutions and training of laboratory staff in POP pesticide related analysis techniques, methods and instrument use, procurement of laboratory equipment.

(see project proposal 3/28 annex 1)

3.3.2.3. Raising Awareness of POPs Pesticides with Particular Reference to Waste and Contaminated Sites

The POP pesticide stocks are of concern to a very large part of the population of Sudan. Pesticides are seen as inherently benign, in the same way that medicines are. Wide-scale information and training is needed to increase the level of caution and gain support for restriction or bans.

All the good practices as well as mitigation activities when introduced, are not enough to combat the adverse effects and to avoid risks. Those directly exposed (farmers, farm workers as well as people living in the areas where the obsolete stocks, contaminated equipment as well as contaminated soil occur, need to be guided directly and indirectly to avoid risks, current and forthcoming, and to contribute into the environmentally sound management practices.

It is important that the information reaches all groups, including women and children. Particularly those who are working in agriculture, and even more important, they are the key to the attitude of the future generations. Training of school teachers and provision of appropriate teaching materials is, therefore, vital.
Sudan has a good experience in operating Farmers Field Schools (FFS) gained from an FAO project (1979 – 1997). FFS will probably be resumed by MOAF.
Even though the assessment of pesticides has not identified specific hot spots, there are some storage areas in the vicinity of the densely populated residential areas, where some concrete awareness activities are obviously beneficial. These actions might include erection of physical barriers, warning signboards and very detailed guidance for the local people and especially children to avoid contacts with the contaminated substances and equipment.

Based on the above considerations the following activities are proposed:

- Preparation of training materials (with popular contents and practical, pragmatic aspects of POPs pesticides
- Media campaigns (TV, radio, newspapers)
- Training of the protectionists and the extensionists in the agricultural areas.
- Training of farmers (farm workers, foremen, local field management).
- To include the pesticide use and in applying alternative methods, including pesticide issue and the related environmental aspects in the appropriate curricula of FFS and training institutes.

(See project profile 4/ 28 annex1)

3.3.2.4. Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides

The preliminary inventory of the obsolete pesticides needs to be updated regarding the detailed quantities of the pesticide substances, volume and condition of containers and the quantities of the contaminated soils to design a detailed action plan, which will lead to the containment of the current obsolete stocks. The current conditions of the stocks as well as the containers present a risk both to the people as well as to the environment. Therefore the people

handling the substances, equipment and soil must be well trained (and provided with proper protective equipment) in the suitable methods and practices. Handling and transportation of POP pesticides presents a risk to the workers and the environment where the actions take place. Planning all the measures in detail in advance as well as conducting environmental impact assessments are necessary to safeguard good results and to avoid the transfer of the problem and potential risks from one place to another.

The Government doesn't propose, at this stage, any final POP pesticides destruction project and or any "final" soil cleaning programme. The main reason for this is still the inadequate knowledge about the feasible destruction and cleaning methods and the financial constraints. It is expected that there will be more options to undertake further measures in very near future and that the costs of these measures are decreasing. In Sudan the biggest difficulty is the large size of the country, long distances and therefore expensive transports and logistics.

The following activities are proposed:
Updating the inventory of obsolete POPs and other pesticides.
Training personnel on database entry and reporting
Training on handling of POPs and obsolete pesticides, damaged and empty containers and contaminated soil.

Environmental impact assessment regarding the collection, repacking, transportation and temporary storage of POPs and other obsolete pesticides.

Construction of two central stores close to the Red Sea ports, for containment of POP pesticides until final destruction abroad.

Repacking of obsolete pesticides and heavily contaminated soil.

Transportation of the packaged pesticides, containers and heavily contaminated soils to the central stores.

(See project profile 5/28 annex 1)

The following four concrete projects corresponding to the POP pesticides related actions discussed above are summarised here below:

Project	Approximate duration and timing	Approximate costs USD
1. Amendment of the Existing Legal Instruments and Strengthening Effective Pesticides Law Enforcement	12 months, 2007 -2008	60,000
2. Strengthening Institutional Capacity to handle POP Pesticides and Contaminated Sites	36 months, 2007-2010	1,590,000
3. Raising Awareness of POP Pesticides with Particular Reference to Waste and Contaminated Sites	60 months, 2007 - 2012	1,575,000
4. Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides	48 months, 2007-2011	1,728,000
Total		**4,953,000**

3.3.3 Strategy and Action Plans to manage and phase-out PCB[15]

Annex Apart II of the SC states, regarding polychlorinated biphenyls that Each Party shall:

(a) With regard to the elimination of the use of polychlorinated biphenyls in equipment (e.g. transformers, capacitors or other receptacles containing liquid stocks) by 2025, subject to review by the Conference of the Parties, take action in accordance with the following priorities:

(i) Make determined efforts to identify, label and remove from use equipment containing greater than 10 per cent polychlorinated biphenyls and volumes greater than 5 litres;

(ii) Make determined efforts to identify, label and remove from use equipment containing greater than 0.05 per cent polychlorinated biphenyls and volumes greater than 5 litres;

(iii) Endeavour to identify and remove from use equipment containing greater than 0.005 percent polychlorinated biphenyls and volumes greater than 0.05 litres;

(b) Consistent with the priorities in subparagraph (a), promote the following measures to reduce exposures and risk to control the use of polychlorinated biphenyls:

(i) Use only in intact and non-leaking equipment and only in areas where the risk from environmental release can be minimised and quickly remedied;

(ii) Not use in equipment in areas associated with the production or processing of food or feed;

(iii) When used in populated areas, including schools and hospitals, all reasonable measures to protect from electrical failure which could result in a fire, and regular inspection of equipment for leaks;

(c) Notwithstanding paragraph 2 of Article 3, ensure that equipment containing polychlorinated biphenyls, as described in subparagraph (a), shall not be exported or imported except for the purpose of environmentally sound waste management;

[15]) This section is based on a comprehensive report: "HCENR, Persistent Organic Pollutants (POPs), Polychlorinated Biphenyls (PCB), National Implementation Plan (NIP), Action Plan for PCBs. Project Profiles for Management of PCBs in Sudan. Sudan Team. March 2006.

(d) Except for maintenance and servicing operations, not allow recovery for the purpose of reuse in other equipment of liquids with polychlorinated biphenyls content above 0.005 per cent;
(e) Make determined efforts designed to lead to environmentally sound waste management of liquids containing polychlorinated biphenyls and equipment contaminated with polychlorinated biphenyls having a polychlorinated biphenyls content above 0.005 per cent, in accordance with paragraph 1 of Article 6, as soon as possible but no later than 2028, subject to review by the Conference of the Parties;
(f) In lieu of note (ii) in Part I of this Annex, endeavour to identify other articles containing more than 0.005 per cent polychlorinated biphenyls (e.g. cable-sheaths, cured caulk and painted objects) and manage them in accordance with paragraph 1 of Article 6;
(g) Provide a report every five years on progress in eliminating polychlorinated biphenyls and submit it to the Conference of the Parties pursuant to Article 15;
(h) The reports described in subparagraph (g) shall, as appropriate, be considered by the Conference of the Parties in its reviews relating to polychlorinated biphenyls. The Conference of the Parties shall review progress towards elimination of polychlorinated biphenyls at five year intervals or other period, as appropriate, taking into account such reports.

Since all the electricity business in Sudan, generation, transmission and distribution, is run by the National Electricity Corporation (NEC), it is natural that also all PCB related activities are centered in and around NEC which is administratively and technically quite competent, to run its business. This capability is achieved through ninety five years of experience in electricity since 1908, the date of the first electric generator was installed at Khartoum. In this review, technical management of the network is, in fact, ensured by the staff of NEC with regard to:
Supply of new material:
*New transformers
*The purchase of mineral oils
Maintenance of the equipment:
*Transformers (NEC owns most, if not all of the transformers in Sudan. The majority of these transformers (approximately 15000) is for the distribution of the power.
*The filtration of mineral oils

Phase out of the apparatus at the end of their lifetime:

*Recycling of metals

*Recycling of oil

NEC doesn't have any expressly stated environmental policy regarding the PCB. The PCB issue started to emerge seriously only in 2001, when Sudan signed the Stockholm Convention. The inventory and the subsequent seminars and training as well as field testing of the sampled transformers has, however, created initial capacity and skills to continue the environmentally sound management of the PCB and PCB containing equipment.

The overall strategy regarding PCBs containing and contaminated equipment is to gear it in the normal business activities of NEC, which activities will be amended and modified to accommodate the requirements of the Stockholm Convention and other environmentally sound practices.

The business of NEC is expanding rapidly concerning the generation, transmission and distribution to clients, households, and industries. This expansion necessarily means technical and technological improvements and new practices. Environmentally sound management will play more important role in the everyday business and technology, being no more an extra burden or cost, but rather a necessity to run the business and the electric network in a proper way. It is expected that NEC will gear the PCB management and phase-out policy to its business plan in a manner, which results in acheiving the specific PCBs related goals of the Stockholm Convention earlier than formally stipulated.

NEC may also expect some signals from its clients (e.g. food industry, hospitals, schools) who want the possibly PCB risk containing equipment to be replaced, not because of technical reasons but as a measure to reduce risks and thus enabling these clients to improve their performance.

Introducing quality and high environmental management standards (e.g. according to ISO 9000 and ISO 14000 series, or equivalent) can be a very effective support tool in achieving the goals.

Based on the above strategy considerations the following nine actions (3.3.3.1. – 3.3.3.9.) are proposed. The actions elaborated are aimed to support NEC in the PCB management. The proposed actions do not include any equipment procurement (except some minor scale laboratory and analysis equipment) or activities which would subsidy the basic operations, i.e. electricity generation, transmission and distribution. As a publicly owned and government monitored company, NEC operations can be easily geared to the objectives of the Stockholm Convention.

The proposed nine actions are supported by nine projects. The nine actions are listed as follows:

3.3.3.1 Develop legal instruments and technical guidelines for managing PCBs

PCB issue became of concern to Sudan only when the country singed the SC in 2001. Different aspects of PCB management particularly import, export, pan and restriction, protection of health in general need adjustment of the present regulations. New laws and regulations may be necessary. New enforcement mechanism may also need to be established.

The following activities are proposed:

- Form a legal and technical working group including all PCB stakeholders.
- To study existing legal instruments related to PCBs management for further development and improvement.
- Develop legal instruments, guidelines, and standards as necessary for PCBs management.
- Organization of workshops for all stakeholders

(See project profile 6/28 annex 1)

3.3.3.2 Comprehensive Inventory of equipments, accessories and articles consisting of containing - or contaminated with - PCBs.

Based on the preliminary inventory only 10% of the inspected transformers have been tested. The results of the tested transformers have been extrapolated to the whole transformer population. A comprehensive inventory is needed. This is essential as a method to enhance the

health of the maintenance workers and the public in the sensitive arias specified in the SC. The purpose of the inventory is to gazer information on the equipment contaminated with PCB all over the country together with the magnitude of the contamination and the distribution of these contaminated equipments . All necessary actions to phase – out or eliminate PCBs and PCB containing equipments will be dependent on this comprehensive inventory.

The following activities are proposed:

- Pilot Inventory Project:
- Study the existing inventory reports and form an inventory team. The team will be responsible for:
- Organizing the existing data into database.
- Taking a random population sample (i.e. 100 units? Or one province?)
- Training the people needed for conducting the inventory.
- Identify and provide the tools and the equipments needed for the inventory, and develop the inventory plan, this will be responsible for Database tool.
- Availing inventory equipments (GPS, sampling equipment, protective items)
- Conduct comprehensive inventory (including testing, classifying, labeling, registering, etc.) of in –use electrical equipment and articles containing and/or contaminated with PCBs. The team will be responsible for field inspection work, collection of data, filing inventory forms, sampling and site testing (density test).

Design and develop national database and information on in-use electrical equipment and article containing and/or contaminated with PCBs. The team will be responsible for Input data in the data base:
Issue technical report and send report to the owner and use undeletable labelling.
Evaluation workshop with stakeholders.
(Introduce the finding and lesson learned from pilot stage for modifying the inventory format and procedures).

Full Inventory project:
The same process with pilot inventory project will apply for full inventory project phase. Full inventory project will also cover on mailing of inventory form, site inspection, sampling and sending of samples to labs for analysis, database, and technical report (labelling).

The following activities are proposed:

3.1. All technical requirements related to ESM and Stockholm Convention recommendation including retention tank for dielectric leaking containers, removing transformers with high corrosion, stop repairing broken PCB transformers and analysis of dielectric before repairing or replacement will apply in the implementation of this project. The detailed activities related to the ESM including:

Identify sites (including worker shops, stations, substations, and pole mounted) selection for prioritized environmental management in a sound manner.
Undertake environmental management in a sound manner at selected sites.
Take action to remove the intention for repairing transformers contaminated with PCBs (with high concentration).
Initial assessment (current and future) of electrical equipment and articles containing and/or contaminated with PCBs.
Develop strategy for the reduction of electrical equipment and articles containing and/or contaminated with PCBs.

Develop and implement PCBs reduction demonstration (pilot) project.
(See project profile 7/28 annex 1)

3.3.3.3. ESM for *in use* equipment

The preliminary inventory found PCBs presence in more than 1.58% and 23.5% still assumed among the 15,000 transformers in-use in country. These transformers were imported during different periods. Delectric fluid from aged transformers for retro-filing into new one and leaking transformers is without clear concepts PCBs hazard and proper management. Most importantly, economic pressure forced to keep in used aged transformers through repairing and recycling processes. NEC is using a site dedicated to a maintenance workshop and storage

of stand-by and decommissioned transformers. In the past, the ESM practices where not considered causing site contamination from handling and dismantling operation.

Activities: Apply all technical requirements related to ESM and Stockholm Convention obligations these will include to avail a retention tank for the dielectric fluids, remove from use transformers with high corrosion and broken transformers (never repair) analyis dielectric for absence of PCB before repairing . Detailed activities include:

- Identify sites (including worker shops, stations, substations, and pole mounted) selection for prioritized environmental sound manner.
- Apply ESM at selected sites.
- Develop the practice of not repairing transformers highly contaminated with PCB.
- Undertake initial assessment of electrical equipment and articles containing and/or contaminated.
- Develop strategy to reduce the quantity of electrical equipment containing or contaminated with PCBs.

See project profile 828annex 1

3.3.3.4. Socio-economic Assessment of (ESM) for in use Equipment

Sudan is face some problems related to the management and economical constrain led to keep some over-aged transformers in-use without proper environmental maintenance and management. This project seeks to develop cooperative long-term assessment of socio-economic aspects in Sudan through the collection and exchange of appropriate data, and the development and application of appropriate assessment techniques.

The following activities are proposed:

- Pilot assessment phase:
  Form a working group of stakeholders to formulate a pilot plan for a risk assessment project (selection of a representative

population sample: 100 units): Site assessment; issues of risk assessment and conclusion workshop with stakeholders on legal, technical and financial issues.

- Full Assessment
  Form a working group of stakeholders to develop a plan of full socio-economic assessment and conduct full site assessment.
- Organize the national conclusion workshop with stakeholders (legal, technical, financial issues).

See project profile 9/28 annex 1

3.3.3.5. Environmentally Sound Management during maintenance and repair of PCB Containing Electric Equipments

The following activities are proposed:

1. Undertake assessment (current and future) of the out-of-use electrical equipment and material containing and/or contaminated with PCBs for destruction including implementation of disposal facilities in the country and evaluation of disposal facilities outside the country.
2. Undertake assessment (current and future) of health and environmental impact issues.
3. Upgrading equipment including documentation of existing equipment if technically appropriate, additional equipment and protection equipment to avoid PCB cross contamination.
4. Building capacities: training of maintenance and repairing technicians related to PCB ESM issues (health and environment issues).

See project profile 10/28annex 1

3.3.3.6 Strengthening laboratory Capacity for PCB analysis

In Sudan at present no laboratories capable of analyzing PCB in-dielectric fluids and items contaminated with PCB whether it is contain in a products or in waste forms . Technical PCBs analysis in Sudan labs can not provide the verification of PCBs presents nor their concentration. The PCBs rapid testing which provides only qualitative analysis requires specific equipment and material and the test should be conducted by trained staff which are not available in Sudan .

The following activities are proposed:

1. Assessment of existing lab facilities and analysis capacities.
2. Provide and strengthen laboratory equipment and staff's capacity for PCBs analysis and adequate capacity building and facilities or PCBs analyses.
3. Selecting appropriate PCB analytical techniques
4. Disseminate laboratory informations and findings to stakeholders.

See project profile 11/28annex 1

3.3.3.7. Environmentally Sound Management (ESM) for out- of-use equipment

Sudan lacks the appropriate management capacity for out of-use electric equipment, articles containing or contaminated with PCBs. The major risk groups would be those involved in recycling metal scrap and the dielectric oil from unknown PCB contaminated out of-use equipment.

The following activities are proposed:

- Training for ESM of the out of use equipment (handling, transportation, storage, dismantling, pre-treatment, shipment of used PCBs abroad for disposal).
- Form a working group (stakeholders).
- Identify storage sites and facilities for keeping the out-of-use of electrical equipment, articles and wastes containing and/or contaminated with PCBs in environmentally sound manner.
- Upgrade or establish if required new stores for keeping the out-of-use electrical equipment, articles and wastes containing and/or contaminated with PCBs in an environmentally sound manner.
- Take action to centralize the out-of-use electrical equipment, articles and wastes containing and/or contaminated with PCBs in an environmentally sound manner.
- Develop a strategy for disposal of the out-of-use of electrical equipment, articles and wastes containing and/or contaminated with PCBs in compliance with ESM requirements.

- ❖ Undertake assessment (current and future) of the out-of-use electrical equipments, articles and wastes containing and/or contaminated with PCBs for destruction including the implementation of disposal cost in the country; and evaluation of the disposal cost out of the country.
- ❖ Conduct with a working group of stakeholders an assessment and evaluation of the disposal of the contaminated used PCBs both inside and out side the country.
- ❖ Develop a strategy for the destruction of the out-of-use electrical equipments, articles and wastes containing and/or contaminated with PCBs (handling, transportation, storage, dismantling, pre-treatment and final disposal).

See project profile 12/28 annex 1

3.3.3.8. Capacity building for awareness raising

PCBs risk problem is relatively new issue for Sudan. Sudan is also lacking the law and the knowledge on the management of PCBs. The technical staff as well as the workers are both exposed to dangerous condition, lack personal protection, and awareness of the risk caused by PCBs. According the obligation of the SC, Sudan will have to provide periodically the updated quantities of PCB in use, decommissioned and disposed of. To comply with regular reporting to SC, that obligation requires a comprehensive follow up and tracking of the population of transformers until 2025. As NEC is in charge of the whole electrical network, the management staff must be trained for this specific purpose. Beside this Sudanese population in general and the electrical equipment repairing personnel in particular are lacking the adequate information about PCB risk and their mitigation. Furthermore people living or workers in sensitive arias like hospitals and schools also lack the adequate knowledge about PCB risk and how to re-act in case of fires and failure of electrical equipment containing of PCBs.

The following activities are proposed:

- ❖ Identify the fields of information and awareness related to PCBs to be provided to the stakeholders.
- ❖ Develop media material on PCB issues.

- ❖ Organize training on PCBs sound management and related issues at national and provincial levels.
- ❖ Organize workshop for all stakeholders.

See project profile 13/28 annex 1

3.3.3.9 PCBs database management

The PCBs is a new concept in Sudan. The PCBs data base guidance from international organizations or other countries may be available and can assist in developing a national data base to assist in cross checking of PCBs for Environmentally Sound Management The NEC is composed of 6 different geographical zone based on the electrical network frame production, transport and distribution. All these units are connected with a central office in Khartoum.

It is essential to improved the network between each unit and the central office in order to timely updating the tracing of transformers.

The following activities are proposed:

1. Design of the database frameworks.
2. Test the database
3. Input available data from inventory and assessment
4. Testing declaration process with PCB stakeholders
5. Networking with other POPs programme
6. Information sharing and distribution

See project profile 14/28 annex1

The nine concrete projects corresponding to the PCB related actions discussed above are summarised here below:

Project	Approximate duration and timing	Approximate costs USD
1. Develop legal instruments and technical guidelines for managing PCBs release	12 months, 2007 - 2009	100,000
2. Comprehensive Inventory of PCB equipment and accessories/articles	12 months, 2007 - 2008	250,000
3. Training for ESM Management for "in use" equipment	2 months + 24 months, 2007 - 2009	250,000
4. Socio-economic Assessment for ESM for "in Use" equipment	24 months, 2007-2010	200,000
5. ESM compliance for electrical equipment	18 months, 2007 - 2008	300,000
6. Strengthening lab capacity for PCB analysis	6 months, 2007	250,000
7. ESM management for "out of use" equipment	1 + 1 + 1 months 2007 - 2008	50,000
8. Capacity building and awareness raising	2 months, 2008	40,000
9. PCB database management (Establishment of database)	2 months, 2008	180,000
Total		**1,570,000**

3.3.4. STRATEGY AND ACTION PLANS TO MANAGE AND PHASE-OUT DDT IN MALARIA/VECTOR CONTROL

Sudan has not applied DDT in the malaria control since 1998 but relied on integrated vector control, careful monitoring of the malaria transmission parameters, international cooperation and information exchange, mainly with the WHO.

Sudan subscribes the WHO position on DDT use in disease vector control under the Stockholm Convention, which position essentially states the following:

1. **The environmental health dangers posed by non-recommended use of DDT are real.**
2. **The safeguards inherent in the WHO recommendations and guidelines on the use of DDT for Disease Vector Control (DVC) present a much diminished environmental and/or health risk, if any. Global use of DDT, if restricted to Indoor Residual Spraying (IRS).**
3. **Periodic review of the continued need for DDT use in DVC, under Stockholm Convention, will be based on available scientific, technical, environmental and economic criteria which take into account the conditions outlined in paragraph 6 of part II of annex B in the Stockholm Convention.**
4. **The restrictions on the use of DDT for DVC provide an appropriate balance between the need to preserve environmental health and the overriding concern to safe human lives/health.**

Sudan is especially cooperating with WHO within the Eastern Mediterranean Region[1] comprises various zoogeographical zones, A fro-tropical, Oriental and Palaearctic. Each of these zones has a specific cluster of dominant vector species. At the margins of their distribution within each zone, vector populations may be less stable and therefore easily controlled by vector control interventions; however, at the core of their distribution area, they are likely to be well-entrenched and will require a more powerful package of interventions to control them to a degree sufficient to have a significant impact on transmission risk. Within each zone, different species will have different ecological requirements. Knowledge of these requirements is fundamental to the development of integrated vector management, which bases itself on an ecosystems approach. An imbalance, caused

[1]) Integrated Vector Management. Strategic Framework for the Eastern Mediterranean Region 2004–2010. World Health Organization, Regional Office for the Eastern Mediterranean

by extreme weather conditions, floods or drought, or by human actions that change the hydrology or land-use patterns, can lead to explosive increases in vector populations with direct consequences on vector-borne disease transmission risks. Chemical interventions in agro-ecosystems, for example, can have similar adverse impacts. Strategies aimed at reducing disease transmission while maintaining or restoring ecosystem integrity are therefore needed.

Sudan will keep DDT in the Registry (Art. 4, Register of specific exemptions) aiming at the exemption from the restriction of use of DDT as stipulated in Annex B, Part I. However this requested exemption is a precautionary measure only enabling Sudan to introduce DDT in case other malaria combating measures are deemed ineffective. Any future uses of DDT will follow the stipulations mentioned in Annex B, Part II.
Sudan has regulations in force as well as a mechanism (controlled by the Ministry of Health and National Malaria Administration), which ensures that DDT, if re-introduced, will be used for disease vector control only.
Sudan is applying, in cooperation with WHO, the Integrated Vector Management (IVM) concept, which involves insecticide resistance monitoring as a routine, regularly conducted using WHO Susceptibility Test Kit and Methods.

Environmental management as a component of IVM must receive great attention and concern.
Because of the high incidence of malaria in the country, huge amounts of anti-malarial drugs are annually consumed that cost a lot of money. This money could best be utilized to sustain a long term multiple preventive program instead of the curative one.

COMPONENTS OF THE ACTION PLAN

3.3.4.1. Country needs assessment:

Paragraph 6 of part II of annex B of the Convention reads as follows:
“Commencing at its 1st meeting, and at least every 3 years thereafter, the COP shall, in consultation with the WHO, evaluate the continued need for DDT for disease vector control on the basis of available scientific, technical, environmental and economic information, including:

a) The production and use of DDT and the conditions set out in paragraph 2 [of part II of annex B];

b) The availability, suitability and implementation of the alternatives to DDT; and
c) Progress in strengthening the capacity of countries to transfer safely to reliance on such alternatives."

WHO/EMRO in its efforts to find alternatives to DDT held several meetings for member countries. These meetings resulted in a GEF Project to support countries using DDT with the aim of introducing IVM as an alternative. The 1st phase of the project is to undertake country needs assessment and to develop an action plan to strengthen IVM capacity in selected demonstration sites. The activities of this phase are as follows:

Establish a national inter-sectoral (GEF/IVM) Steering Committee from relevant stakeholders/ partners

Call first meeting of the Inter-sectoral Steering Committee.

- Discuss and agree on the terms of reference of the ISC
- Agree on the time frame for completing the VCNA
- Identify potential consultants and data collectors

Participation in the First Regional Workshop for Project countries

Adaptation of VCNA tools to local situation

Approval of the tools and finalize plan for VCNA

Recruitment of Consultant (national or international as appropriate)

Orientation of data collectors by Consultant

Carrying out of VCNA (data collection)

Recruitment of Consultant (national or international as appropriate)

Data analysis and VCNA report – including a draft project proposal with support of a Consultant

Convene a meeting of the national Inter-sect oral Steering Committee with Consultant and discuss the report (Full GEF project proposal and IVM plan of action)

Consultant to finalize and present the report to the national Inter-sectoral Steering Committee and other key national partners

Conduct National stakeholders' Consensus workshop:

Preparation for the workshop

Conduct the workshop

Present draft national IVM action plan

Present draft Full GEF Project Proposal

Participation in the Second Regional Workshop for Project Countries

This is a GEF/WHO supported activity

(see project profile 15/28 annex 1)[16]

[16] ***This project has already been executed during the period of this NIP development***

3.3.4.2. Institutional Operational Research:

Primary research is essential to the development of integrated pest and vector management strategies (IPM/IVM). Joint agriculture (FAO) and public health (WHO) initiatives should be developed, including research on alternatives to pesticides and pesticide resistance management.

The activities of this phase are as follows:

- Design and implement pilot integrated vector management program. Implementation should be based on a review of ongoing IVM/IPM program and locally appropriate technology.
- Conduct research on managerial support systems that facilitate the implementation of IVM.
- Conduct research on the incorporation of risk assessment and management measures into infrastructure projects.
- Study the cost-effectiveness of pyrethroids compared to DDT and other adulticides for indoor residual house spraying, in operational settings.
- Study insecticide resistance management.
- Study impregnated mosquito nets as an alternative to DDT. Such research should examine their effectiveness, sustainability, and affordability when provided free for users as a public health measure or commercially under a social marketing scheme.
- Pesticide pricing practices and patents expiration, and options for local production with a view to making alternatives affordable.
- The potential and operational implications of environmental management for malaria reduction in urban and rural areas.
- The impact of selective biological control agents on disease vectors (e.g., applicability of positive results with Larvivorous fish).
- Social and behavioural research on perceived needs and willingness to participate in mosquito / disease control.
- The evaluation of nuisance mosquito control as an incentive for vector control.
- The use of biological control agents such as *Bacillus* spp., fungi, nematodes, in routine programs. Such research should examine their applicability and local production potential.

- Evaluate integrated vector management schemes. Compare their cost- effectiveness and sustainability with single method approaches

  (see project profile 16/28 annex 1)

3.3.4.3. Monitoring and Evaluation of DDT Alternatives:

This is to ensure that DDT elimination is not causing adverse impacts on the health status. In addition, efficacy and appropriateness of alternatives to DDT, including integrated vector management (IVM), must be verified. **The activities of this phase are as follows:**

- Revise, update, and standardize protocols for analysis and data reporting
- Monitor efficacy and appropriateness of alternatives to DDT, including IVM.
- Collect information on the cost increment of alternatives (i.e. the cost margin over and above the cost of DDT), for purposes of subsidizing the cost increment through a financial mechanism.
- ***(See project profile 17/28 annex 1)***

3.3.4.4. Public awareness and community participation:

The Stockholm Convention is a global treaty to protect human health and the environment from the harmful impact of POPs. Community awareness and involvement in this respect is indispensable.

The activities of this phase are as follows:

1. Preparation of suitable and practical training material
2. Conduct media campaigns (TV, radio, newspapers).
3. Conduct appropriate training on:
   - ❖ The impact of DDT on the environment and human health.
   - ❖ DDT alternatives for disease prevention and control, including IVM.
   - ❖ Estimates of the global mortality and morbidity (or DALYs) that are saved through program for the control of malaria and other vector-borne diseases, including the use of DDT residual spraying indoors.

(See project profile 18/28 annex 1)

3.3.5. Strategy and Action Plans to Reduce and Eliminate Releases from Unintentional Production of Dioxins and Furans (UPOPs).

Article 5 of the SC, covering the measures to reduce and eliminate releases from unintentional production states that Each Party shall at a minimum take the following measures to reduce the total releases derived from anthropogenic sources of each of the chemicals listed in Annex C, with the goal of their continuing minimization and, where feasible, ultimate elimination:
(a) Develop an action plan or, where appropriate, a regional or sub-regional action plan within two years of the date of entry into force of this Convention for it, and subsequently implement it as part of its implementation plan specified in Article 7, designed to identify, characterize and address the release of the chemicals listed in Annex C and to facilitate implementation of subparagraphs (b) to (e). The action plan shall include the following elements:

(i) An evaluation of current and projected releases, including the development and maintenance of source inventories and release estimates, taking into consideration the source categories identified in Annex C;
(ii) An evaluation of the efficacy of the laws and policies of the Party relating to the management of such releases;
(iii) Strategies to meet the obligations of this paragraph, taking into account the evaluations in (i) and (ii);
(iv) Steps to promote education and training with regard to, and awareness of, those strategies;
(v) A review every five years of those strategies and of their success in meeting the obligations of this paragraph; such reviews shall be included in reports submitted pursuant to Article 15;
(vi) A schedule for implementation of the action plan, including for the strategies and measures identified therein;
(b) Promote the application of available, feasible and practical measures that can expeditiously achieve a realistic and meaningful level of release reduction or source elimination;
(c) Promote the development and, where it deems appropriate, require the use of substitute or modified materials, products and processes to prevent the formation and release of the chemicals listed in Annex C, taking into consideration the general guidance on prevention and release reduction measures in
Annex C and guidelines to be adopted by decision of the Conference of the Parties;
(d) Promote and, in accordance with the implementation schedule of its action plan, require the use of best available techniques for new

sources within source categories which a Party has identified as warranting such action in its action plan, with a particular initial focus on source categories identified in
Part II of Annex C. In any case, the requirement to use best available techniques for new sources in the categories listed in Part II of that Annex shall be phased in as soon as practicable but no later than four years after the entry into force of the Convention for that Party. For the identified categories, Parties shall promote the use of best environmental practices. When applying best available techniques and best environmental practices, Parties should take into consideration the general guidance on prevention and release reduction measures in that Annex and guidelines on best available techniques and best environmental practices to be adopted by decision of the Conference of the Parties;
(e) Promote, in accordance with its action plan, the use of best available techniques and best environmental practices:
(i) For existing sources, within the source categories listed in Part II of Annex C and within source categories such as those in Part III of that Annex; and
(ii) For new sources, within source categories such as those listed in Part III of Annex C Which a Party has not addressed under subparagraph (d).
When applying best available techniques and best environmental practices, Parties should take into consideration the general guidance on prevention and release reduction measures in Annex C and guidelines on best available techniques and best environmental practices to be adopted by decision of the Conference of the Parties.

The total annual releases of UPOPs in Sudan are estimated at 994,6 g TEQ per annum. Eight (8) main source categories were identified in the preliminary inventory. The source categories are:

1. Waste incineration,
2. Ferrous and non-ferrous metal production,
3. Power generation and heating,
4. Production of mineral products,
5. Transportation,
6. Uncontrolled combustion processes,
7. Production of chemicals and consumer goods,
8. Waste disposal/Landfills.

The preliminary inventory did not cover the following obvious dioxin and furan sources: Cooking with animal dung, occasional forest fires, open water dumping of wastes, and occasional landfill fires. Further,

the estimation of releases from some sources[17] (using the standard toolkit) was obviously biased because the toolkit is based on entirely different technologies than those adopted in Sudan. Therefore, the strategy to tackle UPOPs further, should present actions, which detail and make the releases from sources more accurate. Partially this requires new surveys and field measurements. However, all source categories are, at large, covered by existing Best Available Technology (BAT) and Best Environmental Practices (BEP) references, which can be fruitfully applied also in the Sudanese conditions.

Since Sudan lacks suitable regulatory framework to manage the dioxin and furan releases in general, and further lacks the information and knowledge base to manage the operation/tackling source categories the proposed strategy consists of general actions to strengthen the regulatory framework and institutional capacity. Secondly, several source categories are run as usual industrial/technical and commercial activities on which the established BAT and BEP guidelines and recommendations can be applied. Several of the industrial and the like sources can certainly benefit from the cleaner production concepts, the application of which doesn't necessarily present cost increases but savings (in form of reduced raw material and energy inputs and reduced and/or effectively re-used waste) in a rather short run.

The uncontrolled combustion, in practice the open burning of waste accounts for the largest part (81%) of dioxin and furan releases in Sudan. Waste management and proper waste treatment is the key to the reduction of dioxin and furan releases in Sudan.

Based on the abovementioned general considerations; the following ten actions (3.3.5.1. – 3.3.5.10)[18] are proposed. The actions elaborated are aimed to support the Government in its regulatory, advisory and monitoring role, but also the owners and operators of

[17]) UNEP Standardised Toolkit for Identification and. Quantification of Dioxin and Furan Releases. Geneva 2001

[18] The actions are detailed in the two separate technical reports compiled by the HCENR: 1. Report on BAT/BEP Considerations for Reduction of Unintentionally Formed Persistent Organic Pollutant (UPOPs) Releases in Sudan, March 2006, and 2. Action Plan for Unintentionally Produced Persistent Organic Pollutants (UPOPs) Final Report, March 2006.

the activities and industries, which are the main sources of unintentional production and releases of dioxins and furans (UPOPs)

The proposed actions consist of ten (10) entities as follows:

3.3.5.1. Policy and Legal Framework for the Management of Unintentionally Produced POPs (UPOPs)

Sudan has ratified the Stockholm convention, made inventories and assessed preliminary the issue of the unintentional production of dioxins and furans. However, there is neither a policy nor a legal framework to manage, regulate or take other measures to control the UPOPs. The current regulatory framework consists of scattered paragraphs included in some ten separate acts (and international agreements), which cover only fractions of UPOPs production, and not necessarily from an environmental and human health protection point of view. These issues have been elaborated earlier in chapter 2 of this report. In order to develop a consistent policy and a legal framework to govern the key aspects of production, management and phase-out of the UPOPs is needed.

In formulating this section on POPs the following issues should be clearly highlighted.

*The open burning of the waste: In principle, open burning should simply be prohibited; however, there are practical considerations that speak to the wisdom of defining guidance for open burning with the provision that it should be minimized and eliminated as soon as, and wherever feasible. Those considerations include lack of alternative disposal or recovery methods due to nonexistent or inaccessible infrastructure. In addition, sporadic open burning may be necessary for sanitary disposal of unusual material, to control pathogenes or pests, or in the cases ofbending disasters or emergencies.

* The support for establishment and implementation of proper waste management system is a major task and should be highlighted in the action plan of the Stockholm Convention NIP for reduction of UPOPs in Sudan. The Sudanese government at all level should work diligently to establish and implement sound practices including resource use reduction, reuse, recycling, composting, modern sanitary landfills, and BAT incineration. Convention implementation efforts and the Convention financial mechanism could be used to support the establishment of model waste management systems as alternatives to open burning.

*Regarding the industrial sources of dioxin and furan releases one should note that they are related to flue gas, fly ash, bottom ash, dust and particulate matter emissions as well as indirectly related to the relax control of energy use. Therefore all regulations, which address the abovementioned emissions, but not necessarily the emissions of dioxins and furans, most likely affect these latter emissions, too, i.e. overall reduction of industrial waste will certainly reduce the volume of UPOPs.

The following activities are proposed:

1. Situation analysis of the existing related regulatory mechanisms and the capacities of the concerned institutions.
2. Compilation of the environmental policies, laws and regulations in industrial countries.
3. Identification of gaps and requirements for sound management of UPOPs
4. Amendment of the existing regulations and/or formulate new ones based on the report findings
5. Conduct workshops and seminars with participation of all stakeholders to endorse and disseminate the amended and the new regulations related to the sound management of UPOPs.
6. Produce and disseminate guidelines for all stakeholders and conduct training for the appropriate personnel.

These actions should lead to the needed regulations and enforcements to cover the following :

- Decision on emission of air pollutants from secondary iron, aluminium and copper production .
- Decision on prohibition of open burning practices of municipal wastes.
- Decision for establishing a national body for continuous monitoring and reporting on UPOPs releases.
- Decision on introducing protections and technical measures concerning the existing installations.

(See project profile 19/28 annex 1)

3.3.5.2. Capacity Building and Technical Support.

Since the whole UPOPs issue is a new item for all institutions and organizations, which technically could control the production of UPOPs, deeper and more extensive technical background is

necessary to handle the UPOPs issues to guarantee that the regulatory measures as well as BAT and BEP considerations are based on sound knowledge base. To achieve this, the following activities are proposed:

I. Assessment of the related needs in different, institutions and relevant sectors

II. Establishment of efficient means to exchange information and technology with the active institutions abroad.

III. Encouragement of training/research, both locally and abroad, on environmental engineering, waste management, environmental policy, emission monitoring, waste water management and infrastructure planning.

IV. Build up comprehensive monitoring programme and this should include:

- Type of emission to be covered by monitoring
- Sampling equipment to chose in order to cover wide range of emission with minimum effort.
- Training of Sudanese staff in sampling.
- Establishment of a continuous data reporting and management system in the field of UPOPs.

(See project profile 20/28 annex1)

3.3.5.3. Municipal and Hazardous Waste Management

Waste management and waste treatment are key issues in the whole UPOPs production in Sudan. The open burning of waste accounts for some 81% of the total UPOPs production. The issue, or tackling it, is mostly a combination of some regulatory interventions mainly in the fields; personnel behaviour in technical development. All this against the background that the increase of the waste volumes is unavoidable as well as the increase of hazardous waste.

Good practices in the municipal waste management are initiated in Khartoum and in 4-5 State capitals and also there are initial plans to introduce waste separation process, but in general the starting point is not defined.

Most of the large industrial facilities including potentially UPOPs and POPs emitting industries like tanneries and the textile industries dispose their wastewater either in rivers or on open land. All these issues have to be covered by the development of a waste management system.

The following activities are proposed:

I. Establishment of technical team for sound management of municipal waste
II. Calculation of external costs, health impact, and burden for future of present practice of waste management contamination of land and air by open burning, discharge of industrial waste, emission of SOx, NOx.
III. Study of municipal waste composition in Sudan (a preliminary study regarding the composition of the solid waste in Khartoum has been carried out, but it is obvious that the picture is different in other areas)
IV. Promotion of municipal solid waste separation and collection
V. Evaluation of possibilities of reuse, reduce or recycle
VI. Assessment of the present practice of landfill or dumping of municipal waste
VII. Development of landfill programmes.
VIII. Conduct training courses on landfill management in municipalities of all States for hazardous waste management
IX. Establish technical team to identify and evaluate sources of hazardous waste.
X. Establish a collection system of hazardous waste
XI. Evaluate the possibilities of recycling and reuse of hazardous waste

(See project profile 21/28 annex 1)

3.3.5.4. Residential Combustion, alternatives to present household cooking practices

The demands of the domestic energy sector have put a severe pressure on the precious forest resources. This in itself is a cause for environmental concern. However, a more critical issue is that of the pollution of the indoor air due to the soot, POPs and smoke produced by inefficient combustion of biomass fuels inside the house. Several studies conducted over the last couple of decades have revealed that poor indoor air quality is one of the major factors contributing to the poor state of health of rural women and children in the developing countries.

The simplest solution to the problem is to promote the so-called improved stoves. Sudan has already started a project on natural gas

stoves and will further promote it. Sudan is now technically well placed to initiate the introduction of LPG (and later also with LNG) as a domestic fuel. Also solar panels are a realistic source of power. The POPs project could strongly support the creation of the LPG distribution infrastructure (including the maintenance of the equipment) and the introduction of LPG powered cooking and heating through some pilot projects in areas where the releases can be easily monitored.

A second project should be solar stoves since the sun is mostly shining in Sudan. Also for solar stoves Sudan had a preliminary project, but made limited progress. However, solar technology and in particular solar stoves are improving and could be the technology of choice in the future. Therefore the HCENR or other ministries in combination with Universities should plan a new project on solar stoves for cooking and conduct basic pre-evaluation for a project on solar stoves including:

- Problem analysis of the previous project on solar stoves in Sudan
- Evaluation of successful projects in other developing countries
- Outline of new project including women NGOs and Universities

Sudan should strengthen awareness raising and education on residential combustion. These awareness programs have to be country specific and include the women NGOs active in Sudan.

The following activities are proposed:

- Establish technical team from related parties
- Problem analysis of the previous project on solar stove in Sudan
- Evaluation of successful projects in other developing countries
- Outline of a new project including women NGOs and universities
- Strengthen government project on the use of LPG gas in household cooking

(See project profile 22/28 annex 1)

3.3.5.5. Metallurgical Thermal Processes

For all three metal sectors present in Sudan (iron, copper and aluminium) the technologies applied in medium size and small size companies and family business does not comply with any environmental standards and does not consider industrial safety (protection of worker's health). Smouldering of copper cable will cause high PCDD/PCDF emissions which have potential impact on the human heath of workers and the neighbourhood. This practice

needs to be stopped in future and other practices have to be introduced.

Primary measures are pollution prevention techniques to reduce or eliminate the generation and release of POPs including effective process control and pre-sorting of feed material. Secondary measures are pollution control techniques to prevent emissions including fume and gas collection; and where possible high efficiency dust removal; afterburners, and flue gas quenching. These measures are well known and present proven technologies, which usually pay back very quickly. There is a pressing need of industrial and hazardous waste management in the country. Electric Arc Furnace (EAF) steel manufacturing is an important recycling activity, which contributes to the recovery of steel resources and waste minimization and the operation of the EAF in Sudan, is an important part of Sudanese waste management for material recycling.

The following activities are proposed:
Regarding iron processing

- evaluation of the total amount of iron scrap available in Sudan
- set up a primary and secondary measures to control emission from secondary iron thermal processes (BAT/BEP)
- evaluation of the solid waste (slag, ashes, etc.) generated from the iron thermal processes
- modulate options of reuse, recycle or deposition for the generated solid waste
- study of the possible promotion of EAF in respect to BAT/BEP in existing facilities and recommendation for new ones

Regarding aluminum processing

- evaluation of the total amount of aluminum scrap available in Sudan
- set up of primary measures to control emission from secondary aluminum thermal processes (BAT/BEP)
- Evaluation of the solid waste (slag, ashes, etc.) generated from the aluminum thermal processes
- Modulate options of reuse, recycle or deposition for the generated solid waste
- Study of the possible promotion of EAF in respect to BAT/BEP in existing facilities and recommendation for new ones.

Regarding the secondary processes for copper

- Estimation of the total amount of secondary copper production in Sudan
- Evaluation of the technology used for secondary copper production in Sudan
- Recommendation and adoption of safe technology based on BAT/BEP
- Establish plan for sound treatment of copper cables.

See project profile 23/28 annex1

3.3.5.6. Awareness Raising and Technical Networking

Several of the tasks related to introduction of Best Available Technologies and Best Environmental Practices (BAT/BEP) can be supported by awareness raising process and program.

In addition to awareness raising for the public e.g. waste management issues and open burning of waste and the topic of residential combustion in particular cooking with biomass indoors should be addressed. In addition, a specific awareness raising process should be initiated for decision makers and for the industry. The awareness raising should be a holistic program of environmental education for the public (schools, television, mosques, parliament) and not make a separate concept for POPs. However in particular POPs issues like the contamination of mother milk and endocrine disrupting activities of some POPs (including PCDD/PCDF and PCB) can be used for environmental awareness raising.

The following activities are proposed:

- Select technical team from various parties concerned in UPOPs to develop awareness programme.
- Prepare information and training materials.
- Organize and conduct training courses and seminars for target groups (decision makers, workers, managerial staffs, professionals and public in general) on UPOPs issues.
- Prepare publications, pamphlets and posters on topics requiring much public involvement, like open burning and household cooking.
- Establish network for scientific and technical information on UPOPs.
- Establish focal points for awareness at municipal level.

See project profile 24/28 annex1

3.3.5.7. Land fills and Hazardous Waste Co-incineration

Landfills are the most common practice of waste management around the globe, In particular for in the developing countries. It seems to be the cheapest solution for the increasing waste volumes generated.

However, it becomes more and more recognized that deposition of several waste fractions in landfills has strong drawbacks and creates huge problems for the future. Other waste management options – in particular reuse and recycling – need to be considered and implemented.

For some waste fractions Sudan does not have the appropriate waste management option. These waste fractions include e.g.:

Electronic appliances, PVC, softeners like phthalates or chlorinated paraffin

Other BFR containing waste

Car shredder residues

Other hazardous waste

There are no policies that prohibit disposal of hazardous, industrial and infectious wastes in the normal waste stream

The following activities are proposed

- Develop technical team from government officials, industry and NGOs
- Evaluate commitment of the facilities for their interest to use these waste fractions as secondary fuels
- Evaluate the options for separation from waste stream and collection methods.

See project profile 25/28 annex 1

3.3.5.8. Textile and Leather Dying and Finishing

The textile industry presents one of the most complicated and chemical intensive manufacturing chains. It is a fragmented and heterogeneous sector dominated by small and medium sized enterprises. The annual production in Sudan is estimated to be 2250 tons. According to the Sudanese Inventory, the PCDD/PCDF

emissions from this industry is estimated as 0.23 g TEQ/a. For the textile industry an increase in production might be expected in the next years when considering. The expected economical groth. The main environmental concerns in the textile industry are the amount of water discharged and the chemical load it carries. For 2003 the total effluent from the Sudanese textile industry was 2700 million litres per year without appropriate wastewater treatment measures. Other important issues are chemicals application, energy consumption, air emissions, solid wastes, and odours.

The tanning industry is a potentially pollution-intensive industry with relevant water discharges and uses of certain chemicals as biocides, surfactants, organic solvents and inorganic chemicals of concern (e.g. Cr VI). Tanneries in Sudan are divided into three main groups. These are three big, four medium and ten small tanneries. Their annual production is estimated to 23760 tons. The estimation of PCDD/ PCDF emission 23.8 g TEQ/a[19] (2.4% of total inventory emission).

Based on the considerations above the following activities are proposed:

- Inventory (type and amount) of chemicals used in textile industry
- Assess if chemical used can be substituted byenvironmental ly friendlier ones
- Assess solid wastes and wastewater disposal practice
- Set-up a system for solid waste and wastewater management
- Inventory (type and amount) of chemicals used in leather industry

See project profile 26/28 annex1

3.3.5.9.Inventory of Unintentionally Produced POPS

The inventory of the unintentionally produced POPs carried out for the NIP was a very preliminary one based on secondary data, estimates and calculations. It is necessary to plan and implement

[19] High emission factors were chosen since details on the chemicals used in the leather industry were not known.

detailed, concrete actions and update the inventory, supported by an operational database. The following activities are proposed:

- Form a relevant team to conduct the needed inventory and review the existing reports.
- Identify methodology and support for conducting the inventory
- Train the recruited team in the methodology to be adopted.
- Conduct the inventory on regular bases (each 5-years)
- Generate database on unintentionally produced POPs.
- Evaluate the reduction or elimination of unintentionally produced POPs
- Disseminate the results of evaluation to the concerned parties

See project profile 27/28 annex 1

3.3.5.10. Medical Wastes Management

Basically the incineration of hospital waste have to be evaluated carefully since hospital waste contain normally high concentrations of PVC (high chlorine and heavy metal content) and are located in sensitive areas (near the hospital and inside residential areas).

In hospitals, waste management incineration should be given preference over chemical disinfection for reasons of efficiency and environmental considerations. However when incineration of hospital waste is considered a concept need to be developed through:

- ❖ Centralized incinerator
- ❖ BAT/BEP operation policy
- ❖ Reduction/minimization of PVC

The contract for the chemical treatment technology is already signed for some hospitals for the coming 2 years in Sudan. Therefore it seems that the respective hospitals will have to apply this treatment for some time (or the contract might be evaluated once more in respect to the concerns mentioned above). During this time the project should be critically evaluated. Furthermore, in parallel other technologies and companies should be selected and tested in other hospitals.

The key to hospital waste treatment is an organised hospital waste management system and the separation of waste fractions so that finally only minimized waste streams fall into the classification of hazardous hospital waste. To this extent waste is treated by autoclaving or incineration need further evaluation.

The following activities are proposed:

- Recruit a technical team from concerned parties
- Evaluate the present medical waste management system
- Study of "Technical guidelines on the environmental sound management of biomedical and healthcare wastes" of the Basel Convention Secretariat
- Elaborate on guidelines suitable for Sudan
- Set up strategy for National Action Plan on Medical Waste management implementation.
- Conduct country-wide training on medical wastes management involving local authorities
- Design pilot project on medical waste management
- Implement pilot project on medical waste management

See project profile 28/28 annex 1

The abovementioned ten activities are summarised as follows:

Project	Approximate duration and timing	Approximate costs USD
1. Policy and Legal Framework for Management of Unintentionally Produced POPs (UPOPs)	24 months, 2007 - 2009	100,000
2. Capacity building and Technical Support	36 months, 2007 - 2010	500,000
3. Municipal Waste Management	24 months, 2007 - 2009	275,000
4. Residential Combustion	24 months, 2007-2010	450,000
5. Metallurgical Thermal Processes	12 months, 2007 - 2010	170,000
6.Awareness Raising, Technical Networking	36 months, 2007 - 2010	500,000
7. Hazardous Wastes co-incineration	24 Months, 2007 - 2009	200,000

Project	Approximate duration and timing	Approximate costs USD
8. Textile and leather dying and finishing	12 months, 2007 - 2009	100,000
9. Inventory/database of un-intentionally produced POPs	21 months, split over 2010 - 2015	110,000
10. Medical Wastes Management	36 months, 2007 - 2010	225,000
Total		**2,630,000**

3.3.6. ASSESSMENT AND MITIGATION OF RELEASES FROM STOCKPILES AND WASTES

The stockpiles of obsolete pesticides and the mitigation of possible releases are assessed above in section 3.3.2.

3.3.7. IDENTIFICATION AND MANAGEMENT OF CONTAMINATED SITES

The preliminary inventory did not identify any specific contaminated sites (contaminated soil) except those ones used for storing pesticides, which were discussed in section 2.3.1.4. Some industrial sources of the unintentionally produced POPs can obviously be regarded as contaminated sites, but further and detailed inventory and measures are necessary to identify these sites and the degree of contamination. The issue is discussed in section 3.3.5 .

3.3.8. STRATEGY FOR INFORMATION EXCHANGE

Sudan will actively participate in the available information exchange opportunities provided by the Stockholm Convention. A crucial and instrumental information exchange forum is the WHO; Sudan's strategy is to eliminate the use of DDT in combating malaria and other diseases.

It is envisioned that parts of the NIP will be implemented through the UNDP and UNIDO; therefore Sudan is actively liaising with these agencies regarding the financial and technological opportunities to combine the POPs related mitigation and management activities with other (e.g. cleaner production) on-going and forthcoming activities.

Regional cooperation with the Red Sea **Council** calls for exchanging the relevant information especially on the marine environment.

3.3.9. PUBLIC AWARENESS, INFORMATION AND TRAINING

Public awareness in general is discussed above in section 3.3.1 and further in sections 3.2.1 -2.3.5 when presenting the sector and source-wise implementation strategies. It is generally recognized that the public awareness as well as the availability of and access to the information will be very crucial in mitigating the adverse effects of the POPs, The main source categories of the unintentionally produced POPs, uncontrolled burning of waste and using wood and charcoal for domestic cooking, can be approached only through public awareness and information campaigns as indicated in the concerned sections above.

Training is also recognized as a key issue, especially at this early stage of the implementation, when there is need for monitoring, technical information collection and other basic information on POPs. Training components are included in the action plans covering pesticides, PCB and unintentional production of POPs.

3.3.10. MONITORING

The actual monitoring of releases (and potential releases) from all POPs sources (pesticides, PCB, unintentional production) is a key condition for the effective implementation and directing the concrete management and elimination actions. However, Sudan is not aiming to establish any comprehensive monitoring programme yet but wants first to enhance the technical and laboratory capacity and training of the experts to be able to carry out the monitoring as indicated in the sector- wise project proposals. Due to the large size of the country and the obvious logistical difficulties as well as the financial restrictions the monitoring capacity to be developed will reflect the national priorities; POPs pesticides, uncontrolled combustion, waste incineration are to be monitored in the first instance. Regarding the industrial sources of dioxins and furans the industrial companies are encouraged to establish monitoring arrangements of their own, since they are obviously economically self-supporting guiding the process of development towards decreased releases, which basically present more sustainable resource use and saving of raw materials.

3.3.11. REPORTING

The reporting, compilation of the national reports/information for the use by the stakeholders will be made as regular as possible. It is expected that Sudan will compile annual reviews/monitoring reports to be discussed within the Government and MNCC (or a similar body) presenting the relevant stakeholders. These reports will also make the basis for the regulatory report as referred to in Art. 15.1 of the Stockholm Convention ("Each Party shall report to the Conference of Parties on the measures taken to implement…)

Regarding the possible statistics to be provided to the Secretariat (Art. 15.2) on the production, import and export of POPS, such reporting need is not foreseen (except in a vary rare case that DDT should be imported for malaria/vector control). In case said occurrences happen the government will naturally provide the Secretariat with the appropriate information. In case the obsolete POPs pesticides and PCB are exported for final **destruction the appropriate regulations of Basel convention will be followed i.e. Any control actions or other activities will be notified to the Rotterdam Conventions as required.**

3.3.12. STRATEGY FOR RESEARCH AND DEVELOPMENT

The active implementation of the Stockholm Convention provides more applied research in Sudan. The research is closely related to the improvement of the monitoring capacity. As mentioned above in section 3.3.10 the monitoring capacity and the insufficient analysis equipment present one of the most serious obstacles.

3.4. CAPACITY BUILDING AND PRIORITIES

The proposed actions are based on clearly expressed priorities as described in section 3.2. Basic Implementation Strategy above. The most urgent capacity building needs are related to the management and mitigation of the adverse effects of the POPs pesticides, which is reflected in the proposed action plan covering this sector. Setting the pesticide issue as the most urgent and important one in Sudan is based on a wide national consent. Regarding the human and environmental impacts the tackling of obsolete pesticides contributes the most immediate and direct positive results.

3.5. TIME SCHEDULE OF IMPLEMENTATION AND FOLLOW-UP

The bulk of the actual implementation activities and interventions is planned for the time period of 4-5 years from now till 2010-2011.

During that period most of the regulatory and other legal issues should be addressed. Also the active POPs management and phase-out in the industry and businesses should be going on in a few years.

The issue of the obsolete POP pesticides and the contaminated containers and soil should be fully surveyed and planned within the coming five years including a firm plan to destroy the substances as well as a plan to handle the contaminated containers and plan to treat the contaminated soil. The awareness activities, mainly addressed to the general public and people in direct touch with the obsolete stocks and their remains, should have been effectively implemented and resulted in such awareness and behaviour that helped the people to avoid the risks being impacted by the POPs.

Waste management, including managed landfills and proper treatment of industrial and hazardous waste should have been initiated. The PCB issue, management of PCB substance itself as well as the replacement of the PCB containing transformers as well as the environmentally sound management of the in-use and out-of-use transformers should be in place and the comprehensive database covering all transformers in Sudan should be operational.

It is expected that the proposed institutional strengthening and capacity building project within HCENR will develop performance indicators and milestones for the NIP Implementation.
The performance indicators to be developed are to observe the development of the impacts of the projects (as well as the amended regulatory framework) on the POPs releases and the observed exposure risks. Initially, due to the lack of comprehensive reference data and information (as well as due to the lack of monitoring and analysing equipment and the financial restriction to procure and use them), these indicators are obviously rather general concentrating in secondary observations (like the awareness raising, number of trained people, collected waste volumes, number and spread of dioxin/furan sources etc.)
Milestones to be developed should serve as a time-wise measure of the project implementation.
Regarding the proposed projects, when it comes to compile actual, technical project documents, the project should include clear measurable and observable, quantitative performance indicators as

well as time wise milestones; when activities and other interventions are supposed to be accomplished.
The MNCC (or a similar body) will continue its overall monitoring activities by arranging sessions/seminars at least annually reviewing both the implementation of the projects and the performance, i.e. the impact of the actions on the humans and environment and ecology. The MNCC is also obliged to review the general POPs related policy and especially the development of regulatory framework and implementation of the subsequent legislation by the concerned governmental bodies. Furthermore, the MNCC is supposed to review the priority order of POPs management and phase-out activities and to discuss and propose appropriate adjustments to it based on the actual development.

3.6. RESOURCE REQUIREMENTS

Total costs of the proposed actions and the related projects are summarized in table 2.16.

Table 2.16. The estimated costs of the proposed projects in the five action areas related to POPs

Action area	**Costs of the proposed projects USD**
Institutional Strengthening	300,000
Pesticides	4,953,000
PCB	1,570,000
DDT/Malaria*	1,541,000
UPOPs	2,630,000
Total	**10,994,000**

The costs of the DDT elimination activities through Sudan's participation in the Eastern Mediterranean Roll Back Malaria programme within the WHO frame are not included in this budget. Most of the estimated costs present incremental costs. However, the following considerations can be made regarding certain sector wise cost items:

- Pesticides: Infrastructure improvement of storage facilities partially serve the current and forthcoming business of the agricultural enterprises and therefore possible non-

incremental parts of the estimated costs should be assessed in detail when the concerned project proposals and documents are being prepared

- All the PCB related actions are run by the National Electricity Corporation. Managing PCB has been a normal part of the business while the activities and related costs to speed-up the transformer maintenance programme present the incremental elements. The possible non-incremental elements of the costs should be assessed in details when the concerned project proposals and documents are being prepared.
- Unintentional production of POPs in the industrial sector can be often tackled by measures and investments, which increase efficiency and pay back very quickly. Even though the budget estimates of the proposed projects basically presents the incremental cost elements of the activities related to the industries and it should be reviewed when the concerned project documents are prepared.

Sudan understands that the Global Environmental Facility has opportunities to finance the majority of the incremental costs of the proposed projects.

Regarding the industry related projects and their costs Sudan will seek funding opportunities, also through UNIDO, aiming to run cleaner production programmes.

Bilateral funding will be sought as appropriate. It is obvious that the opportunities to involve bilateral donors will increase when the economic and political situation in the country improves.

ANNEX (1)

Project No. 1/28: : Strengthening of Stockholm Convention Focal point (HCENR)	
1. Implementing Agency[20]	Higher Council for Environment and Natural Recourses
2. Responsible Institutions[21]	Higher Council for Environment and Natural Recourses, supported by the key ministries, NGOs, Universities and research institutions.
3. Duration	5 years
4. Location	All the country
5. Background	Sudan has compiled, according to Stockholm Convention, the NIP, which covers, substance wise the management and phase-out of POPs pesticides, PCB and dioxins and furans. The implementation of NIP effectively consists of technical interventions,
6. Project Justification	The NIP compilation work has indicated that HCENR is able and capable to run a longer term activity and coordinate the efforts. This project is a logical continuation for the NIP compilation
7. Project Goal	Keeping the practical POPs management and phase-out organisa active and prepare documentation (technical and financial) actual technical and related activities
8. Objectives	Maintain the POPs issue on the environmental agenda and secure the involvement of relevant bodies in the NIP implementation. The work of MNCC is to continue.
9. Target field/group	Governmental institutions
10. Activities	❖ Enhancement of POPS related regulatory framework, monitoring, information dissemination, development of milestones and performance indicators to measure the success of implementation. ❖ To strengthen HCENR capacity to act as a focal point for Stockholm Convention Implementation this include: ❖ Coordination of sectorial efforts and activities. ❖ Liase with international and regional related organizations. ❖ Seek funding from local regional and international organizations. ❖ Insure smooth and successful NIP implementation.
11. Estimated Cost	**300,000 USD**
12. Donors	International donors, GEF

[20]) Agency formally/contractually responsible towards the external/domestic financier
[21]) Agency, organisation participating, contributing to the project implementation, cooperating with the implementing agency

POPs Pesticides Projects
(2/28-5/28)

Project No. 2/28: Amendment of the existing legal instruments and Strengthening Pesticides Law Enforcement	
1. Implementing Agency	**Higher Council for Environment and Natural Recourses**
2. Responsible Institutions	Min of Justice, Min of Agriculture, National Pesticide Council, SAGA, Universities and research institutions
3. Duration	12 months
4. Location	Khartoum
5. Background	The current legislation regarding pesticides doesn't recognise the POPSs pesticide issue.
6. Project Justification	Fresh experience gained during the NIP development should be utilised in making strong enforceable legislations for POPS pesticides for the purpose of compliance with the obligation of the Stockholm Convention.
7. Project Goal	To eliminates POPs pesticides according to SC in Sudan
8. Objectives	1. To strengthen the legal basis as a tool for the elimination of POPs pesticides. 2. To strengthen the enforcement capacity in the country for the establish POPs pesticides laws and regulations.
9. Beneficiaries	Sudanese population at large and in particular people involved ,farmers, storekeepers ..etc.
10. Activities	1. Formulating a legal team assisted by the relevant technical experts to review and assess the existing legislations, and to improve the legal instruments related to the POPs pesticides. 2. Update the existing legislations and develop effective legal instruments from cradle to grave. 3. Develop rules and regulations to bridge any gaps in the updated regulations. 4. Develop a system for monitoring, inspection and environmental impact assessment to guard against any illegal traffic of POPs . 5. To adopt international technical guidelines for pesticides management
11. Estimated Cost	60,000 USD
12. Donors	GEF

PCB Projects
6/28 – 14/28

Project No. 3/28 : Strengthening the Capacity to Handle POPs Pesticides, Containers and Contaminated Soil	
1. Implementing Agency	**Higher Council for Environment and Natural Recourses**
2. Responsible Institutions	HCENR, Ministry of Agriculture, Ministry of Health, Ministry of Interior. SAGA, Universities and Research Instituions
3. Duration	36 months
4. Location	Khartoum, State capitals
5. Background	The handling, including legal/administrative procedures, of the pesticides and POPs is sometimes very relaxed. The upgrade of the skills is mandatory
6. Project Justification	The action supports effective law enforcement
7. Project Goal	To eliminates POPs pesticides according to SC in Sudan
8. Objectives	Enhance and upgrade the skill of people who manage the stock piles of POPs pesticides.
9. Beneficiaries	Sudanese population at large and in particular people involved ,farmers, storekeepers ..etc.
10. Activities	1. Training of trainers to train traders, sailors, chemical personnel.. 2. Upgrading the laboratory capacity at local/regional level and training of laboratory staff in POPs pesticide related analysis techniques, methods and instrument use. 3. Procurement of laboratory equipment.
11. Estimated Cost	1,590,000
12. Donors	GEF

Project No.4/ 28: Pesticides : Raising Awareness on POPs Pesticides with Particular Reference to Waste and Contaminated Sites	
1. Implementing Agency	**Higher Council for Environment and Natural Recourses**
2. Responsible Institutions	Regional/state administrations, farmers´' associations, universities, NGOs, women's associations.
3. Duration	60 months
4. Location	Throughout Sudan
5. Background	The people who are involved in the pesticides handling and the people who are living in the vicinity of the pesticide stores are mostly not be aware of the risks of POPs pesticides. Most vulnerable groups are the children and the farm workers in agricultural areas. Though Farmers Field Schools had been establish in most part of the agricultural schemes areas, however, the information reaching the risk groups is considered far from being adequate.
6. Project Justification	Public campaigns are the most cost effective tools in the protection of the public from POP pesticides risks.
7. Project Goal	To eliminates POPs pesticides according to SC in Sudan and to mitigate their adverse effects.
8. Objectives	Protect the general public, farmers and workers from the adverse impacts of POPs.
9. Beneficiaries	General public in agricultural areas, farmers and workers handling pesticides.
10. Activities	1. Preparation of training materials with a popular contents and practical, pragmatic aspects of POPs pesticides. 2. Media campaigns (TV, radio, newspapers). 3. Training of agricultural extensionists. 4. Training of farmers, farm workers, foremen, local field management in applying alternatives methods of crop protection. 5. Introducing pesticide issue and the related environmental aspects in the appropriate curricula of universities and institutes.
11. Estimated Cost	1,575,00 USD
12. Donors	Agricultural Schemes, GEF and FAO

Project No. 5/28: Undertaking Ecologically Sound Measures to Eliminate Obsolete POP Pesticides	
1. Implementing Agency	**Higher Council for Environment and Natural Recourses**
2. Responsible Institutions	National Pesticide Council, Agricultural companies, Min. of Works
3. Duration	48 months
4. Location	Country/Wide
5. Background	According to the surveys carried out in 2004 - 2005 the quantity of obsolete POPs pesticide stocks is 234 tons spread over some 340 storage sites throughout the country In addition to pesticide substances some 527 tons of contaminated pesticide containers (drums) were identified. The quantity of contaminated soil is estimated at 8,850 tons. Moreover there are about 400 tons of left-over seeds dressed with POP pesticides.
6. Project Justification	The project is obviously a tangible mitigation exercise setting an example of how to manage POP pesticides. The POPs pesticide management and phase-out needs concrete actions, which will result in measurable improvements in the environment and human health
7. Project Goal	To eliminates POPs pesticides according to SC in Sudan and to mitigate their adverse effects.
8. Objectives	The reduce the risk of POPs pesticides by putting them under control and monitoring.
9. Beneficiaries	Population at large
10. Activities	1. Updating the inventory of obsolete pesticides including POP pesticides. 2. Training personnel on database entry and reporting. 3. Training on collection and repackaging of POPs and obsolete pesticides, damaged and empty containers and contaminated soil. 4. Undertake environmental impact assessment pesticides containment operations, repacking, transportation and temporary storage of POPs and other obsolete pesticides. 5. Construction of two central stores, one for POPS pesticides and the other for the heavily contaminated containers. 6. Repacking of obsolete pesticides in existing storages and contaminated soil in already available drums by the previously trained personnel. 7. Transportation of the packaged pesticides, containers and contaminated soils to the central stores
11. Estimated Cost	1,728,000 USD
12. Donors	UNDP and GEG

Project No. 6/28: Develop legal instruments and/or technical guidelines for managing PCBs	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR, Ministry of Health
3. Duration	12 months
4. Location	Khartoum
5. Background	PCB issue became of concern to Sudan only when the country singed the SC in 2001. Different aspects of PCB management particularly import, export, pan and restriction, protection of health in general need adjustment of the present regulations. New laws and regulations may be necessary. New enforcement mechanism may also need to be established. The following activities are proposed:
6. Project Justification	The main potentially exposed population is the workers and employees working in workshops, warehouses, and power plants are critically affected by PCBs due to lack of protective materials and protective laws and regulations. The people who deal with contaminated PCBs oil are expected to be facing negative impact from PCBs. This group of people could be protected by legal instruments and/or technical guidelines for managing PCBs release.
7. Project Goal	1. The environmental management until the end of the life time of electrical equipment containing PCBs.
8. Objectives	Laying out and implementation of a specific PCB regulation. Regulate the in-use and out-of-use of electrical equipment and accessories/articles containing and/or contaminated with PCBs through ESM approach.
9. Beneficiaries	Workers and Employees of all power plants and also all the people in the vicinity of this plant
10. Activities	1. Form a legal and technical working group including all PCB stakeholders and HCENR. 2. Study existing legal instruments related to PCBs management for further development as necessary. 3. Develop legal instruments, guidelines and/or, standards as necessary for PCBs management. 4. Organization of workshops for all stakeholders.
11. Estimated Cost	US$ 100,000
12. Donors	NEC, UNDP/GEF,

Project No. 7/28: Comprehensive Inventory of equipments, accessories and articles consisting of containing - or contaminated with - PCBs.	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR
3. Duration	12 months
4. Location	Sudan (Six geographical operational zones of NEC).
5. Background	Based on the preliminary inventory report, only 10 % of the inspected transformers have been tested. The result of tested transformers was extrapolated to cover the whole transformer population. The result of proposed inventory should be added to the existing result. Detailed information on PCBs substance is of much concern in Sudan, particularly for ESM plans to eliminate them.
6. Project Justification	The compliance with the obligation of Stockholm convention related to inventory. Nictitate ESM of PCBs. The inventory information provided by relevant stakeholders for will be analyzed. Comprehensive inventory provided precise information for long term run of ESM management of PCB equipment and accessories and articles.
7. Project Goal	1. Sound environmental management of PCB until the end of the life time of the electric equipments.
8. Objectives	1. Evaluation of quantities of PCB in Sudan. 2. Identification of PCB holders. 3. Collecting technical data related to the PCB equipment and materials. 4. ESM situation of PCB.
9. Beneficiaries	1. Direct beneficiaries: Electrical stakeholders. 2. Indirect beneficiaries: Industrial sector and services sectors and public at large.
10. Activities	1. Pilot Project to study the existing inventory reports and form inventory team. to be responsible for organizing the existing data into database and selection of a population sample. 2. Identify the support tool and equipments for inventory. Develop inventory plan. 3. Conduct a comprehensive industry and design and develop a national data base. 4. Design and develop national database and information on in-use electrical equipment and articles. Organize workshops with stakeholders. 5. Undertake full Inventory project following the same process as the pilot inventory project. Organize data base and produce, technical report showing labrotary analysis during the full inventory project.
11. Estimated Cost	US $250.000
	(NEC), UNDP/GEF,

Project No. 8/28: **ESM for *in use* equipment**	
Implementing Agency	NEC, Ministry of Energy & Mining, Stakeholder
1. Responsible Institutions	HCENR
2. Duration	2 months for Technical and regulatory aspects of PCB management
3. Location	Sudan (Six geographical operational zones of NEC).
4. Background	The preliminary inventory showed PCBs presence in more than 1.58% and 23.5% still assumed among the 15,000 transformers in-use in country. These transformers were imported during different periods. Delectric fluid from aged transformers for retro-filling into new ones and leaking transformers is without clear plan. Most importantly, economic pressure forced to keep in use aged transformers through repairing and recycling processes. NEC is using a site allocated for maintenance and storage of stand-by transformers. In the past, the ESM practices were not considered causing site contamination through handling and dismantling operations.
5. Project Justification	Ensure ESM of PCBs upon completion of this project by providing broader environmental and technological requirement processes including retention tank for dielectric leaking risk, removing transformers with high corrosion, stop repairing of broken PCB transformers.
6. Project Goal	Sound environmental management of PCB until the end of the life time of the electric equipments.
7. Objectives	1. Full comprehensive training of NEC Staff and other concerned entities for the ESM management of PCB in including all the technical aspects: technical, environmental, health impact, regulation. 2. The environmental management of PCB until the end of life time of electric equipment. 3. The economical aspect of the PCB management.
8. Beneficiaries	Direct Beneficiaries: Electrical stakeholders, Indirect Beneficiaries: Industrial sector, service sector and the public.
9. Activities	Detailed activities include 1. Identify sites (including workshops, stations, substations, and pole mounted) for prioritized actions environmental sound management. 2. Undertake environmental sound management at selected sites. 3. Take action to remove the intention for repairing transformers contaminated with PCBs (high concentration). 4. Initial assessment (current and future) of equipment and articles containing and/or contaminated with PCBs. 5. Develop strategy for the reduction of electrical equipment and articles containing and/or contaminated with PCBs. 6. Develop and implement PCBs reduction demonstration (pilot project).
10. Estimated Cost	US$ 250.000
11. Donors	WHO, GEF and UNDP

Project No. 9/28: Socio-economic Assessment of (ESM) for in use Equipment	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR
3. Duration	24 months
4. Location	Sudan (Khartoum)
5. Background	Sudan is facing some problems related to the management and economical constraint that led to keep some over aged transformers in-use without proper environmental maintenance and management. PCBs socio-economic assessment method will be chosen in order to integrate in the most efficient way the relatively scarce information and knowledge, available with particular stakeholders in Sudan.
6. Project Justification	This project seeks to develop cooperative long-term assessment of socio-economic aspects in Sudan trough the collection and exchange of appropriate data, and the development and application of appropriate assessment techniques. The project will show the possible PCBs management options by means of socio-economic cost/benefit analysis in order to ensure that implementation of Stockholm Convention in Sudan will be socially and economically feasible.
7. Project Goal	The environmental management of PCB until the end of transformers life.
8. Objectives	Establish decision tool for socio economic assessment of PCB equipment use during their life cycle.
9. Beneficiaries	Direct beneficiaries: electrical stake holders. Indirect beneficiaries: industrial sector, service sector and the public.
10. Activities	Phase 1: Pilot assessment phase: a. Form a working group of stakeholder (NEC). b. Plan a pilot risk assessment project (selection of a representative population sample: 100 units). c. Site assessment. d. Identify issues of risk assessment. e. Conclusion workshop with stakeholders (legal issues, technical issues, financial mechanism) Phase 2: Full Assessment: Form a working group of stakeholder. b. Develop a plan of full risk assessment. c. Conduct full site assessment .Organize the national conclusion workshop with stakeholders (legal, technical, social and financial issues)
11. Estimated Cost	US$ 200,000
12. Donors	GEF and other International Agencies

Project No. 10/28: Environmentally Sound Management during maintenance and repair of PCB Containing Electric Equipments	
1. Implementing Agency	HCENR
2. Responsible Institutions	NEC, Ministry of Energy & Mining
3. Duration	18 months
4. Location	Sudan (Khartoum)
5. Background	In Sudan, PCBs are identified and found in electrical equipment. At present PCBs are existing in the use of transformers and PCBs oil residue after used is a source of threat to the health and environment in Sudan due to lack of ESM compliance of the maintenance and repairing activities of electrical equipment. In general, the key problems identified is dielectric oil contaminated PCBs have been sold for other users; old transformers contained PCBs are continued to be used in Sudan without proper management caused by heating, spilling and leaking; improper disposal of equipment contaminated with PCBs and PCBs contaminated sites (workshop, warehouse …) are easily accessed by the public.
6. Project Justification	This project is essential for the assessment regarding the maintenance and repairing activities of electrical equipment, upgrading of repairing facilities, documentation of PCB contaminated materials, and building capacities to ensure protection of workers health.
7. Project Goal	To establish an environmentally sound management of PCB until the end of transformers life .
8. Objectives	Improvement of ESM for the repairing and maintenance of electrical equipment.
9. Beneficiaries	NEC maintenance staff and the public at large
10. Activities	Undertake assessment (current and future) of the out-of-use electrical equipment and material containing and/or contaminated with PCBs for destruction including implementation of disposal facilities in the country and evaluation of disposal facilities outside the country. Undertake assessment (current and future) of health and environmental impact issues. Upgrading equipment including documentation of existing equipment if technically appropriate, additional equipment and protection equipment to avoid PCB cross contamination. Building capacities: training of maintenance and repairing technicians related to PCB ESM issues (health and environment issues).
11. Estimated Cost	12. US$ 300,000
13. Donors	GEF and other International Agencies

Project no. 11/28: Strengthening Laboratory Capacity for PCB analysis	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR
3. Duration	6 months
4. Location	Sudan (Khartoum)
5. Background	No laboratories in Sudan are capable of targeting to analyze PCB substances whether it is contained in the products or in waste form. Technically, PCBs analysis in Sudan labs can not provide the actual PCBs concentration, nor the verification of PCBs presence. The PCBs actual tests require specific testing equipment and materials and the test should be conducted by a trained staff. Some tests can provide only an overall concentration of PCBs while other tests may identify the presence of individual PCB congeners.
6. Project Justification	It is necessary to improve the capacity of Sudan laboratories for PCBs analysis. The actual implementation of this project will cover all the efforts needed for the improvement of the laboratory staff capacity particularly in PCBs analysis in all electrical equipment and materials in use and out of use.
7. Project Goal	The environmental management of PCB until the end of transformers.
8. Objectives	Improve a full segregation of PCB and non PCB electrical equipment and material in use, for maintenance and out of use to be in compliance with ESM and SC.
9. Beneficiaries	The key main beneficiaries including the electrical equipment and repairing activities, EDC, electrical equipment holders, warehouse, and the ministry of environment.
10. Activities	1) Assessment of existing lab facilities and analysis capacities. 2) Provide and strengthen laboratory equipment and staff's capacity for PCBs analysis and adequate capacity building and facilities or PCBs analyses. 3) Selecting appropriate PCB analytical techniques 4) Disseminate laboratory informations and findings to stakeholders
11. Estimated Cost	US$ 100,000
12. Donors	GEF and other International Agencies

Project No. 12/28: Environmentally Sound Management (ESM) for out-of-use Equipment	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR
3. Duration	3 month
4. Location	Sudan (Khartoum)
5. Background	Sudan lacks the appropriate experience in the management of out-of-use equipment, articles and wastes containing and/or contaminated with PCBs and disposal facilities. As PCB is a hazardous substance and a hazardous waste. The population of the entire transformer is subjected to strict regulation for handling and transportation. The PCB transformers in use must be phased out before 2025.During these 20 years, it is important to plan the disposal and replacement of PCB transformers for technical and financial reason. This phase out programme is based on the normal life time which is 30 years according to the management rule of NEC on one side and on the risk level on the other side. NEC in future will face problems of safe PCB storage facility and the cost of shipment PCB abroad.
6. Project Justification	1. It is of vital importance to collect adequate information and data on out-of-use of equipment, articles and wastes containing and/or contaminated with PCBs for the purpose of developing safety and sound environment practices in the NEC. 2. ESM of out of-use of electrical equipment, articles and wastes contaminated with PCBs. 3. Strategy for elimination
7. Project Goal	The environment management of PCB equipment until the end of life.
8. Objectives	Develop a safety and environmentally combatable practices in the NEC.
9. Beneficiaries	Direct Beneficiaries: Electrical stakeholder. Indirect Beneficiaries: Industrial Sector.

10. Activities	1) Training for ESM of the out of use equipment (handling, transportation, storage, dismantling, pre-treatment, shipment of used PCBs abroad for disposal). 2) Form a working group (stakeholders). 3) Identify storage sites and facilities for keeping the out-of-use of electrical equipment, articles and wastes containing and/or contaminated with PCBs in an environmentally sound manner. 4) Upgrade or establish if required new stores for keeping the out-of-use electrical equipment, articles and wastes containing and/or contaminated with PCBs in an environmentally sound manner. 5) Take action to centralize the out-of-use electrical equipment, articles and wastes containing and/or contaminated with PCBs in an environmentally sound manner. 6) Develop a strategy for disposal of the out-of-use of electrical equipment, articles and wastes containing and/or contaminated with PCBs in compliance with ESM requirements. 7) Undertake assessment (current and future) of the out-of-use electrical equipments, articles and wastes containing and/or contaminated with PCBs for destruction including the implementation of disposal cost in the country; and evaluation of the disposal cost out of the country. 8) Conduct with a working group of stakeholders an assessment and evaluation of the disposal of the contaminated used PCBs both inside and out side the country. 9) Develop a strategy for the destruction of the out-of-use electrical equipments, articles and wastes containing and/or contaminated with PCBs (handling, transportation, storage, dismantling, pre-treatment and final disposal).
11. Estimated Cost	US$ 50,000
12. Donors	GEF and other International Agencies

Project No. 13/28: Capacity building for awareness raising	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR
3. Duration	2 months for the awareness campaign.
4. Location	Sudan (Khartoum)
5. Background	PCBs risk problem is relatively new issue for Sudan. Sudan is also lacking the law and the knowledge on the management of PCBs. The technical staff as well as the workers are both exposed to dangerous condition, lack personal protection, and awareness of the risk caused by PCBs. According the obligation of the SC, Sudan will have to provide periodically the updated quantities of PCB in use, decommissioned and disposed of. Comply with regular reporting to SC, that obligation requires a comprehensive follow- up and tracking of the population of transformers until 2025. As NEC is in charge of the whole electrical network, the management staff must be trained for this specific purpose.
6. Project Justification	This project aims to comply with Stockholm convention obligation in order to protect public health and the environment from PCB impact. Another purpose of this project is to raise PCBs awareness and promote action for PCBs impact prevention among top policy makers in the government. Decisions are ultimately a political responsibility, but the likelihood of the best choices being made is greatly enhanced when there is a widespread understanding and knowledge of all the implications.
7. Project Goal	The environment management of PCB equipment until the end of life.
8. Objectives	1. To improve the health and environment of all stockholders of electrical equipment. 2. Raise awareness of NEC engineer and maintenance workers on ESM of PCB management and Stockholm convention obligation related to Total Quality Management (TQM) of NEC.
9. Beneficiaries	Direct Beneficiaries: l stakeholder of electrical. Indirect Beneficiaries: Industrial Sector, public and private sectors.
10. Activities	1) Identify the fields of information and awareness related to PCBs to be provided to the stakeholders. 2) Develop media material on PCB issues. 3) Organize training on PCBs sound management and related issues at national and provincial levels. 4) Organize workshop for all stakeholders& awareness.
11. Estimated Cost	US$ 40,000
12. Donors	GEF and other International Agencies

Project No. 14/28 PCBs database management	
1. Implementing Agency	NEC, Ministry of Energy & Mining
2. Responsible Institutions	HCENR
3. Duration	2 months (implementation of a database)
4. Location	Sudan (Khartoum)
5. Background	The PCBs database is new concept and consequently there is no data base for its ESM in Sudan. not existing available PCB database for ESM for Sudan yet. However, the PCBs database experience from UNEP/GEF or from other countries may be available and can help in verifying the cross-checking of PCBs for ESM. The NEC compose of 6 different geographical zones based on the electrical network frame: Production, transport and distribution. All these units are "connected" with a central office in Khartoum. Considering the obligation of regular reporting of PCB in use and out of use to the SC, it is essential to improve a networking between each unit and the central office in order to timely update the tracking of transformers.
6. Project Justification	A country such as Sudan with poor capability in database design, a well coordination and cooperation referenced PCBs database would offer immense advantages over limited information management system.
7. 8 Project Goal	The environment management of PCB equipment until the end of life.
8. Objectives	Training for the implementation of a full database to ensure the tracking and follow up of the transformers until 2025 and PCB waste until 2028.
9. Beneficiaries	NEC and stakeholders, Academic Institutions, Research Centers
10. Activities	♦ Design of the database frameworks. ♦ Test the database ♦ Input available data from inventory and assessment ♦ Testing declaration process wit PCB stakeholders ♦ Networking with other POPs program ♦ Information sharing and distribution
11. Estimated Cost	US$ 180,000
12. Donors	GEF and other International Agencies

DDT ALTERNATIVES PROJECTS (15/28 -18/28)

Project No.15/28: Country needs assessment*	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	Ministries of Health (Federal & State), Environment, Agric., NGOs, industry, Irrigation and other stakeholders (members of the Inter-sectoral Committee)
3. Duration	12 months
4. Location	All over Sudan
5. Background	The Stockholm Convention is a global treaty to protect human health and the environment from harmful impacts of persistent organic pollutants (POPs including DDT). Strategy development requires identification Country needs assessment
6. Project Location	DDT phasing out Strategy development requires conducting situation analysis to identify country needs assessment thro' detecting gaps and finding opportunities.
7. Project Goal	Eliminate DDT use for vector control in Sudan
8. Objectives	Protect the general public where residual insecticides – including DDT-applied and spray men from the adverse impacts of DDT
9. Beneficiaries	General public and workers handling pesticides
10. Activities	Establish a national inter-sectoral (GEF/IVM) Steering Committee from relevant stakeholders/ partners Call first meeting of the Inter-sectoral Steering Committee Discuss and agree on the terms of reference of the ISC Agree on the time frame for completing the VCNA Identify potential consultants and data collectors Participation in the First Regional Workshop for Project countries Adaptation of VCNA tools to local situation Approval of the tools and finalize plan for VCNA Recruitment of Consultant (national or international as appropriate) Orientation of data collectors by Consultant Carrying out of VCNA (data collection) Recruitment of Consultant (national or international as appropriate) Data analysis and VCNA report – including a draft project proposal with support of a Consultant Convene a meeting of the national Inter-sectoral Steering Committee with Consultant and discuss the report (Full GEF project proposal and IVM plan of action) Consultant to finalize and present the report to the national Inter-sectoral Steering Committee and other key national partner Conduct National stakeholders' Consensus workshop: Participation in the Second Regional Workshop for Project Countries
12. Estimated Cost	91,000 $ - DONE
13. Donors	GEF (65,00 $), WHO (8,000,00 $), Government o Sudan (8,000,00 $)

**** Has already been executed***

Project No.16/28: Institutional Operational Research	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	Universities, Nat. Malaria Cont. Prog., Nat. Health Lab. & Nat. Chemical Lab., Blue Nile Research & Training Instit. and Sennar Mal. Train. Cent.
3. Duration	60 months
4. Location	Research Institutes & where DDT & its alternatives applied in Sudan
5. Background	Sudan has not applied DDT in the malaria control since 1998 but relied on integrated vector control, careful monitoring of the malaria transmission parameters, international cooperation and information exchange, mainly with the WHO. Sudan will keep DDT in the Registry (Art. 4, Register of specific exemptions) aiming at the exemption from the restriction of use of DDT as stipulated in Annex B, Part I. However this requested exemption is a precautionary measure only enabling Sudan to introduce DDT in case other malaria combating measures are deemed ineffective. Any future uses of DDT will follow the stipulations mentioned in Annex B, Part II. Sudan has regulations in force as well as a mechanism (controlled by the Ministry of Health and National Malaria Administration), which ensures that DDT, if re-introduced, will be used for disease vector control only.
6. Project Justification	Research and development on IVM including alternative for DDT is an essential tool to phase out DDT use in Sudan.
7. Project Goal	Eliminate DDT use for vector control in Sudan
8. Objectives	Undertake research to identify effective and economically viable alternatives to DDT .
9. Beneficiaries	General public and Nat. Malaria Cont. Prog.,
10. Activities	♦ Design and implement pilot integrated vector management program. Implementation should be based on a review of ongoing IVM program and locally appropriate technology. ♦ Conduct research on managerial support systems that facilitate the implementation of IVM. ♦ Conduct research on the incorporation of risk assessment and management measures into developmental projects. ♦ Conduct cost-effectiveness studies of pyrethroids compared to DDT and other adulticides for indoor residual house spraying, in operational settings. ♦ Study the insecticide resistance management. ♦ Undertake studies impregnated mosquito nets as an alternative to DDT. ♦ Study the impact of selective biological control agents on disease vectors (e.g., applicability of positive results with Larvivorous fish). ♦ Undertake social and behavioral research on perceived needs and willingness to participate in mosquito / disease control. ♦ Evaluate the use of biological control of mosquitoes. ♦ Evaluate integrated vector management schemes. Compare their cost- effectiveness and sustainability with single method approaches.
12. Estimated Cost	500,000$
13. Donors	WHO, UNICEF, TDR and GEF

Project No.17/28: Monitoring and Evaluation of DDT Alternatives	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	National Pesticide Council, Industry, M. of Works & Health
3. Duration	60 months
4. Location	where residual insecticides – including DDT-applied Sudan
5. Background	Sudan has not applied DDT in the malaria control since 1998 but relied on integrated vector control, careful monitoring of the malaria transmission parameters, international cooperation and information exchange, mainly with the WHO. Sudan will keep DDT in the Registry (Art. 4, Register of specific exemptions) aiming at the exemption from the restriction of use of DDT as stipulated in Annex B, Part I. However this requested exemption is a precautionary measure only enabling Sudan to introduce DDT in case other malaria combating measures are deemed ineffective. Any future uses of DDT will follow the stipulations mentioned in Annex B, Part II. Sudan has regulations in force as well as a mechanism (controlled by the Ministry of Health and National Malaria Administration), which ensures that DDT, if re-introduced, will be used for disease vector control only.
6. Project Goal	Eliminate DDT use for vector control in Sudan.
7. Objectives	• Protect the general public and spray men from the adverse impacts of DDT
8. Beneficiaries	General public and workers handling DDT
9. Activities	• Revise, update, and standardize protocols for analyses and data reporting. • Monitor efficacy and appropriateness of alternatives to DDT, including IVM. • Collect information on the cost increment of alternatives (i.e. the cost margin over and above the cost of DDT), for purposes of subsidizing the cost increment through a financial mechanism.
10. Estimated Cost	200,000 $
11. Donors	WHO, UNICEF, TDR, GEF

Project No.18/28: Public awareness and community participation	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	Federal/State Ministries of Health, NGOs and industry
3. Duration	60 months
4. Location	where residual insecticides – including DDT-applied Sudan
5. Background	Sudan has not applied DDT in the malaria control since 1998 but relied on integrated vector control, careful monitoring of the malaria transmission parameters, international cooperation and information exchange, mainly with the WHO. Sudan will keep DDT in the Registry (Art. 4, Register of specific exemptions) aiming at the exemption from the restriction of use of DDT as stipulated in Annex B, Part I. However this requested exemption is a precautionary measure only enabling Sudan to introduce DDT in case other malaria combating measures are deemed ineffective. Any future uses of DDT will follow the stipulations mentioned in Annex B, Part II. Sudan has regulations in force as well as a mechanism (controlled by the Ministry of Health and National Malaria Administration), which ensures that DDT, if re-introduced, will be used for disease vector control only.
6. Project Justification	Public awareness campaigns using mass-media proved to be effective and cost-effective of legal or any illegal use in Sudan.
7. Project Goal	Eliminate DDT use for vector control in Sudan
8. Objectives	Protect the general public 'where residual insecticides – including DDT- applied' and spray men from the adverse impacts of DDT
9. Beneficiaries	General public and workers handling pesticides
10. Activities	1. Preparation of suitable and practical training material 2. Media campaigns (TV, radio, newspapers). 3. Conduct appropriate training for health on: ▪ The impact of DDT on the environmental and human health. ▪ DDT alternatives for insect control, including IVM. ▪ Estimates of the global mortality and morbidity (or DALYs) that are saved through program for the control of malaria and other vector-borne diseases, including the use of DDT indoor residual spraying. ▪ The potential exemptions for DDT use in the POPs treaty. 4. Expeditiously disseminate ongoing results of the WHO Action. In particular distribute the scientific results of alternative strategy implementation and IVM projects
12. Estimated Cost	750,000 $
13. Donors	WHO, UNICEF, TDR and GEF

UPOPS PROJECTS
19/28 – 28/28

Project No. 19/28: Policy and Legal Framework for Management of UPOPs	
1. Implementing Agency	**Higher Council for Environment and Natural Recourses**
2. Responsible Institutions	MOJ, MOH, MOE, MOI, NGOs, Private sector
3. Duration	24 months
4. Location	Khartoum
5. Background	According to Article 5 of Stockholm Convention, Sudan is obligated to evaluate the efficacy of the laws and policies related to the management of unintentionally produced POPs. There are no authorized government institutions for UPOPs regarding their health hazards and impact on the environment. The current Environmental Act is an umbrella law and it has no specific regulations, standards or by-laws regarding the management of unintentionally produced POPs
6. Project Justification	The analysis of current legal framework in Sudan to control the of unintentionally produced POPs and commit to Stockholm Conventions has highlighted the necessity of creation of legal framework. For the purpose of eliminating, preventing, and minimizing the releases of unemotionally produced POPs a number of regulation (acts, rules, standards, guidelines) should be developed. The regulation should clarify monitoring, reporting, inspection, implementation, and enforcement responsibilities of all parties involved. An integrated environmental system should be developed and provisions for BAT and BEP regarding POPs sources (new and existing) addressed. The regulatory requirements should also be transferred into practical and operational guides, as well as introduced to the general public in simple and understandable terms.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs. National legal framework.
8. Objectives	1.Overview of the existing legal framework. 2. Amend/develop regulations for management of UPOPs. 3. Develop guidelines for enforcement of the regulations
9. Beneficiaries	Government agencies
10. Activities	1. Situation analysis of the existing related regulatory mechanisms and capacity of concerned institutions. 2. Evaluation of environmental policies, laws and regulations in industrial and developing countries. 3. Report the findings together with identification of gaps and requirements for sound management of activities leading to the releases of UPOPs. 4. Form a legal team to amend the existing regulations and/or draft new ones based on the report findings. 5. Conduct a workshop with participation of all stakeholders to endorse the amended and new regulations related to the sound management of UPOPs . 6. Conduct seminars for the concerned legislators. 7. Print and disseminate the new and amended regulations. 8. Develop guidelines for UPOPs management. 9. Conduct training on the developed guidelines . 10. Disseminate the developed guidelines for all stakeholders
11. Estimated Cost	98,000 USD
12. Donors	GEF

1- Project No. 20/28 Capacity Building and Technical Support	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOE, MOH, MOI, Universities, Private sector
3. Duration	36 months
4. Location	Khartoum
5. Background	The responsible ministries and authorities in the related sectors in Sudan do not have enough manpower with the required skills to conduct surveillance which leads to strengthening their capacity to manage risks caused by UPOPs. There are no actual monitoring systems and data that could be used to decide which emission type and limits to be monitored and regulated
6. Project Justification	The capacity and capability of institution could be build through contact with specific environmental agencies and institutes abroad. The establishment of own monitoring capacity in Sudan for key emissions (dust, CO, SOx, NOx, HCl, VOC, UPOPs, heavy metals) is one basic prerequisite for proper implementation of BAT/BEP measures in particular for large-scale plants. Contacts might be developed by sending policy makers and engineers abroad and by taking part in activities of the UN in the environmental sector. . Interesting fields for submission of students to Universities in industrialized countries for master course or PhD are Environmental engineering, environmental policy, waste management, water management, emission monitoring , analysis and infrastructure planning.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	1.Building capacities of national institution. 2. Provision of trained technical staff. 3. Provision of monitoring equip.
9. Beneficiaries	Governmental agencies, largest dioxin and furan processes
10. Activities	1. Assessment of the needs in ministries, institutions and relevant sectors. 2. Study tours abroad for decision makers and engineers in relevant institutions. 3. Research and study in environmental engineering, waste management,environmental policy, emission monitoring, waste water management and infrastructure planning. 4. Build up a comprehensive monitoring programme and this should include: - ♦ type of emission to be covered ♦ sampling equipment to chose in order to cover work ♦ range of emission with minimum effort ♦ training of Sudanese staff in sampling and analysis ♦ establishment of data reporting and management system in the field of UPOPs.
11. Estimated Cost	500,000 USD
12. Donors	International donors

Project No. 21/28: Municipal and Hazardous Waste Management	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOE, MOH, Local municipalities, NGOs, MOST, Universities
3. Duration	24 months
4. Location	Khartoum
5. Background	The grand total of solid wastes generated is approximately 12000-13000 tons per day. From the inventory conducted in 2004 it is obvious that open burning of wastes is the key emission source of dioxins and furans in Sudan, with 81.0% of the total PCDD and PCDF release. According the inventory 50% of wastes in Khartoum state is not covered by present waste management is burned in open piles or barrels. In other parts of the country it is estimated by the inventory that 25% of the wastes generated from household is burned in open piles or barrels. Waste management is presently organised to some level in the largest towns in eight states. The open burning of waste takes place to a large extent on private ground. However, there are also larger areas even within Khartoum city where municipal and other waste is gathered and combusted. There is no active waste separation is established. Careful study of local waste composition may lead to specific programs for reduction of large volume streams
6. Project Justification	In principle, open burning should simply be prohibited; however, there are practical considerations that speak to the wisdom of defining guidance for open burning with the provision that it should be minimized and eliminated as soon as and wherever feasible. Those considerations include lack of alternative disposal or recovery methods. Although the Stockholm Convention is concerned with POPs such as polychlorinated dibenzodioxins and furans (PCDD/PCDF), HCB and PCBs as products of incomplete combustion, open burning is responsible for generation of toxic by-products of combustion. Sudan federal government together with the States governments should work diligently to establish and implement sound practices including resource use reduction, reuse, recycling, composting, modern sanitary landfills, and BAT incineration.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	Reduction and sound management of municipal waste
9. Beneficiaries	Municipalities and municipal waste management operators
10. Activities	1. Establishment of technical team to develop sound management system for municipal waste. 2. Calculation of costs, health impact, and burden of the present practice of waste management . 3. To study municipal waste composition in Sudan. 4. Promotion of municipal solid waste collection and segregation. 5. Evaluation of possibilities of waste reuse, reduce or recycle. 6. Assessment of present practices of landfilling and dumping. 7. Development of landfill programme. 8. Conduct training courses on landfill management in all States.

	9. Establish technical team to identify and evaluate sources of hazardous waste with the assistance of the regional Basel centre in Cairo. 10. Establish of collection system of hazardous waste with the help of the regional Basel centre.
11. Estimated Cost	275,000 USD
12. Donors	International donors

Project No. 22/28: Residential Combustion	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MO EM, MOST, Universities, Women groups , NGOs, MOH
3. Duration	24 months
4. Location	Khartoum
5. Background	Sudan uses biomass as the primary source of energy. In 1995 biomass contributed to about 78% of Sudan total energy consumption. Wood charcoal, natural wood and agricultural crop residues are extensively used for cooking. The demand for the domestic energy sector have put a severe pressure on the precious forest resources. This in itself is a cause for environmental concern. However, a more critical issue is the pollution made indoor by the soot, POPs and smoke produced by inefficient combustion of biomass fuels inside the house. Several international studies conducted over the last couple of decades have revealed that poor indoor air quality is one of the major factors contributing to the poor state of health of rural women and children in the developing countries.
6. Project Justification	The simplest solution to the releases from residential combustion is to promote the so-called improved stoves. Sudan has already started a project on natural gas stoves and will further promote it. Sudan is now technically well placed to initiate the introduction of LPG (and later also with LNG) as a domestic fuel. Also solar panels are a realistic source of power. The POPs project could strongly support the creation of the LPG distribution infrastructure (including the maintenance of the equipment) and the introduction of LPG powered cooking and heating through some pilot projects in areas where the releases can be easily monitored. Secondly solar stoves can be introduced since the sun is always shining in Sudan. Also for solar stoves Sudan had a preliminary project, but not well promoted. However, solar technology and in particular solar stoves are improving and could be the technology of choice in the future. Therefore the concerned ministries in combination with Universities , women groups and NGOs should plan a new project on solar stoves for cooking.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	Develop alternatives to replace the present household cooking practice
9. Beneficiaries	The whole population, especially rural population and people living in the outskirts of urban areas.
10. Activities	1. Establish a technical team. 2. Undertake problem analysis of the previous projects on solar stove and charcoal stove in Sudan. 3. Evaluate successful projects in other developing countries. 4. Outline a new project including women NGOs, universities and research institutions. 5. Strengthen governmental project on the use of LPG in household cooking.
11. Estimated Cost	450,000 USD
12. Donors	International donors

Project No. 23/28: Metallurgical Thermal Processes	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOI, MOE, MOH, MOST, Universities, NGOs, private sector
3. Duration	12 months
4. Location	Khartoum
5. Background	Annex C (of the SC) source categories secondary iron, secondary aluminium, and secondary copper production are present in Sudan and covered in the PCDD/PCDF inventory. The secondary iron industry had a total production of 33000 tons/a and a TEQ emission of 0.75 g/a. In the inventory the totally processed secondary copper quantity was estimated at 36 tons/a. On the other hand the total amount of secondary copper in Sudan is considerably larger and the largest amount is exported (e.g. to India). Furthermore, a large share of this copper is recovered by open smouldering of cables. Most of the cables are burned outside cities in industrial areas emitting the toxic fumes to the neighbouring companies. Many local foundries re-melt aluminium scrap. The total amount of aluminium is estimated to ca. 1650 t/a. This thermal process is performed without dust removal or any pollution control system. According to the PCDD/PCDF inventory the secondary aluminium industry has a TEQ emission of 0.9 g/year. The sector of secondary iron industry can roughly be categorized in three levels: 1.Heavy industry complex with large scale production (Electric Arc Furnace), 2. Small foundries with less than ca. 30 employees, 3. Informal sector with small smithies. Electric Arc Furnace (EAF) is process known to be emitting high emissions of dust, heavy metals as well as PCDD/PCDF and other UPOPs. On the other hand it is recognized that no alternate steel making technology would replace the EAF for the high production operations of steel plants. Therefore EAF steel manufacturing is an important recycling activity, which contributes to the recovery of steel resources and waste minimization and the operation of the EAF in Sudan is an important part of Sudanese waste management for material recycling. The biggest company (GIAD) has one EAF with a theoretical capacity of 60000 t/year. The EAF is operated ca. 50% of the time. The plan of the company is to build two new EAF and increase capacity to 120000-180000 t/year. Therefore the EAF process will gain more importance in the future also in respect to environmental relevance and emission considerations including POPs. The whole metal sector urgently needs the management of solid waste as one of the most important BEP considerations in this industrial sector. In particular it has to be evaluated where the solid materials (slag, ashes etc.) can be reused, recycled or deposited in an environmental acceptable manner.
6. Project	For all three metal sectors present in Sudan (iron, copper and aluminium)

Justification	the technologies applied in medium size and small size companies and family business does not comply with any environmental standards and do not consider industrial safety (protection of workers' health). Smouldering of copper cable will cause high PCDD/PCDF emissions which have potential impact on the human heath of workers and the neighbourhood. This practice needs to be stopped in future and other practices have to be applied.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	1. Introduction of BAT/BEP in thermal processes. 2.Improvement of EAF techniques. 3Better management for production
9. Beneficiaries	Metal industry workers and public at the large
10. Activities	1. Evaluation of the total amount of iron scrap available in Sudan. 2. Set up a primary and secondary measures to control emission from secondary iron thermal processes (BAT/BEP). 3. Evaluation of the solid waste (slag, ashes, etc.) generated from the iron thermal processes, 4. Modulate options of reuse, recycle or deposition for the generated solid waste. 5. Study of the possible promotion of EAF in respect to BAT/BEP in existing facilities and recommendation for new ones. 6. Evaluation of the total amount of aluminum scrap available in Sudan. 7. Set up of primary measures to control emission from secondary aluminum thermal processes (BAT/BEP), 8. Evaluation of the solid waste (slag, ashes, etc.) generated from the aluminum thermal processes. 9. Modulate options of reuse, recycle or deposition for the generated solid waste. 10. Study of the possible promotion of EAF in respect to BAT/BEP in existing facilities and recommendation for new ones. 11. Estimation of the total amount of secondary copper production in Sudan. 12. Evaluation of the technology used for secondary copper production in Sudan. 13. Recommend on the safe used technology based on BAT/BEP. 14. Establish plan for sound treatment of copper cables.
11. Estimated Cost	85,000 USD
12. Donors	(GEF/UNIDO)

Project No. 24/28 Awareness raising and Technical network	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOE, MOH, MOE., NGOs, municipalities, universities
3. Duration	36 months
4. Location	Khartoum
5. Background	The present level of awareness on UPOPs related problems among most of the stakeholders is very low. There are no serious concerns about UPOPs negative environmental and health impact. Their mitigation and elimination are not taken as a priority. Awareness of UPOPs is almost non-existent. Lack of institutionalized communicable channels, expertise, ineffectiveness of information dissemination, are all shared in poor UPOPs awareness and ignorance among various stakeholders. Also no reliable and accessible source of information is available in the country.
6-Project Justification	Several of the tasks related to National Implementation Plan can be supported by awareness raising process and program. The awareness rising of the public for e.g. on waste management issues and open burning of wastes and for the issue of residential combustion sources in particular cooking indoor with biomass is very important. Awareness raising should be initiated for the decision maker and the industry.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	To transfer knowledge and information to the concerned parties
9. Beneficiaries	General public
10. Activities	1. Recruit technical team from various parties concerned with UPOPs to develop awareness programmes. 2. Prepares information and training materials. 3. Organize and conduct training courses and seminars for target groups (decision makers, workers, managing staffs, professionals) and public in general on UPOPs issues. 4. Prepare publications, (Pamphlets and posters) on topics requiring much public involvement, like open burning and household cooking. 5. Establish a network for scientific and technical information on UPOPs. 6. Establish focal points for awareness at municipal level.
11. Estimated Cost	500,000 US$
12. Donors	Foreign donors

Project No. 25/28: Landfill and Hazardous Wastes co-incineration	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOE, MOH, Local municipalistes, NGOs, MOST, universities
3. Duration	24 months
4. Location	Khartoum
5. Background	Landfills are the most common practice of waste management around the globe. For developing countries it seems to be the cheapest solution for the increasing waste volumes generated. However, it becomes more and more recognized that deposition of several waste fractions in landfills has strong drawbacks and creates huge problems for the future. Other waste management options – in particular reuse and recycling – need to be considered and implemented. For some waste fractions Sudan does not have an appropriate waste management option. These waste fractions include e.g.: • Electronic appliances, PVC, softeners like phthalates or chlorinated paraffin • Other BFR containing waste • Car shredder residues • Other hazardous waste There are no policies or specific laws and regulations that prohibit disposal of hazardous, industrial and infectious wastes in the normal waste stream At the moment there are no secured landfills in Sudan and most disposal sites are unmanaged and can be classified as dump sites. In Khartoum there is a newly managed site, which was planned to open at the end of 2005. Therefore the quality of landfills might improve in future. The present landfilling practice (including the evaluation of leaching from landfills in arid countries) needs a comprehensive evaluation, and considerable improvements.
7. Project Justification	Large fraction of today's household waste contain hazardous substances including heavy metals, brominated flame retardants and other persistent toxic substances, pharmaceuticals etc. This is anticipated for waste like batteries and mercury containing halogen lamps. Provision of hazardous wastes system will enhance the safety of the municipaldisposal system.
8. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
9. Objectives	Improve landfill waste management Sound management of hazardous waste
10. Beneficiaries	General public, municipalities, organisations running landfills

11. Activities	1. Assessment of the present practice of landfill or dumping of municipal waste, 2. Conduct training courses on landfill management of hazardous waste in municipalities at all States management. 3. Establish technical team to identify and evaluate sources of hazardous waste, 4. Establishment of collection system of hazardous waste evaluate the possibilities of recycling and reuse of hazardous waste
12. Estimated Cost	225,000 USD
13. Donors	International donors

Project No. 26/28 Textile and Leather Dying and Finishing	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOI, MOE, MOST, MOH, Universities, private sector
3. Duration	12 months
4. Location	Khartoum
5. Background	According to the Sudanese Inventory, the PCDD/PCDF emission from this industry is estimated to be 0.23 g TEQ/a. For 2003 the total effluent from the Sudanese textile industry is 2700 million litres per year without wastewater treatment measures.. Their annual production of tanneries is estimated to 23760 tons. The estimation of PCDD/ PCDF emission 23.8 g TEQ/a (2.4% of total inventory emission)
6. Project Justification	For the textile industry an increase in production might be expected in the next few years when considering that generally economy will grow and considering the availability of electricity due to the start of operation of the Merawi dam. The main environmental concerns in the textile industry are the amount of water discharged and the chemical load it carries. The tanning industry is a potentially pollution-intensive industry with relevant water discharges and the use of certain chemicals as biocides, surfactants, organic solvents and inorganic chemicals of concern (e.g. Cr VI). With respect to BAT/BEP considerations the chemicals used in the Sudanese leather and textile industry should be evaluated for their environmental relevance and the possibility of substitution by less hazardous chemicals. The water effluents of industries according to the Stockholm Convention (textile, leather, metal) should be treated.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	1. Substitution of environmental hazardous chemicals, 2. Best environmental management of textile and leather discharge
9. Beneficiaries	Public at large
10. Activities	1. Review (type and amount) of chemicals used in textile industry. 2. Assess if the chemicals used could be substituted by environmentally friendlier ones. 3. Assess solid wastes and wastewater disposal practice. 4. Set-up a system for solid wastes and wastewater management. 5. Review (type and amount) of chemicals used in leather industry. 6. Assess if chemical used can be substituted by environmentally friendlier ones. 7. Set-up a system for wastewater management.
11. Estimated Cost	50,000 USD
12. Donors	International donors

Project 27/28 Inventory of Unintentionally Produced POPs	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOE, MOH, MOI, MOEM, NGOs, Private sector, Universities
3. Duration	21 months
4. Location	All Sudan
5. Background	No comprehensive inventory to identify the releases of UPOPs has been ever conducted in Sudan. Only preliminary inventory taken in 2004 using UNEP Standardized Toolkit for Identification and Quantification of Dioxin and Furans. The result of the inventory showed that total amount of PCDD/PCDF released from all source categories estimated to be 991.6 TEQ/a. The availability of unintentionally produced POPs inventory results can be viewed as valuable information for government, industry, and the public as mechanism to stimulate reduction in UPOPs emission
6. Project Justification	A comprehensive inventory is needed in order to evaluate the exact situation of UPOPs in Sudan in a manner to enable Sudan to comply with Stockholm Convention obligations with regard to unintentionally produced POPs release minimization. Such inventory data is necessary for follow-up of measures taken to eliminate or reduce UPOPs releases.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	Identification and quantification of UPOPs release Production of database on the releases of unintentionally produced POPs
9. Beneficiaries	Authorities responsible for Dixon and furan monitoring and source management/permitting
10. Activities	1. Recruit a team and review the existing preliminary inventory report. 2. Identify methodology and support for conducting the comprehensive inventory. 3. Train the recruited team in the inventory methodology. 4. Conduct comprehensive inventory on regular bases (each 3-years). 5. Generate database on unintentionally produced POPs release and establish a clearing house. 6. Evaluate the reduction or elimination of unintentionally produced POPs. 7. Disseminate the results of evaluation to the concerned parties
11. Estimated Cost	110,000 USD
12. Donors	International donors

Project No. 28/28 Medical Waste Management	
1. Implementing Agency	Higher Council for Environment and Natural Recourses
2. Responsible Institutions	MOH, MOE, NGOs, local governments,
3. Duration	36months
4. Location	Khartoum
5. Background	Wastes generated in most of the hospitals and clinics in the country, if not all, go without any treatment in the stream of municipal wastes or for open burning as a usually common practice. This practice expose hazards to medical staff, in-and-out patients, workers in support services, workers in disposal facilities, and the general public.
6. Project Justification	Compliance with Stockholm Convention obligation with regard to unintended POPs by-product release minimization, and promotion of BAT/BEP in all sources.
7. Project Goal	Reduce and/or eliminate where as possible, the release of unintentionally produced POPs.
8. Objectives	Revision of the present concept of hospital waste treatment Outline strategy for medical waste management
9. Beneficiaries	Health care sector, hospitals and the general public.
10. Activities	1.Recruitment of a technical team, 2. Evaluate the present medical waste management system, 3. Study of "Technical guidelines on the environmental sound management of biomedical and healthcare wastes" of the Basel Convention Secretariat, 4. Elaborate on the guidelines suitable for Sudan, 5. Set up strategy for National Action Plan implementation, 6. Conduct country-wide training on medical wastes management treatment involving local authorities, 8. Design and implement a pilot project on medical waste management.
11. Estimated Cost	200,000 USD
12. Donors	International donors

Project	Approximate duration and timing	Approximate costs USD
1. Policy and Legal Framework for Management of Unintentionally Produced POPs (UPOPs)	24 months, 2007 - 2009	100,000
2. Capacity building and Technical Support	36 months, 2007 - 2010	500,000
3. Municipal Waste Management	24 months, 2007 - 2009	275,000
4. Residential Combustion	24 months, 2007-2010	450,000
5. Metallurgical Thermal Processes	12 months, 2007 - 2010	170,000
6.Awareness Raising, Technical Networking	36 months, 2007 - 2010	500,000
7. Hazardous Wastes co-incineration	24 Months, 2007 - 2009	200,000
8. Textile and leather dying and finishing	12 months, 2007 - 2009	100,000
9. Inventory/database of un-intentionally produced POPs	21 months, split over 2010 - 2015	110,000
10. Medical Wastes Treatment	36 months, 2007 - 2010	225,000
Total		**2,630,000**

ANNEX (2)

Experts and monitors who participated in the compilation of the NIP in 2004-2005

INVENTORY AND ASSESSMENT TEAM for PESTICIDES (Annex A, Part I substances)

Prof. Nabil Hamid Hassan Bashir, Head, Department of Pesticides & Toxicology
University of Gezira.
Dr. Yousif Osman Assad , University of Gezera
Mr. Mohammed Ahmed Morgan, Gezera Scheme
Mr. Salah Eldin Ismail, Ministry of Agriculture , Blue Nile State
Mr. Eltayeb Rahama, Ministry of Agriculture, North Kordofan State
Mr. Siddig Abdalla, University of Gezera
Mr. AbdelGadir Darweish, Ministry of Agriculture , Gezera State
Mr. Nizar Ibrahim, Ministry of Agriculture , Gezera State
Mr. Hashim Yousif, University of Gezera
Mr. Abdelrahman M. Khair, Plant Protection Directorate
Mr. Abdelrahim Binawi, National Pesticides Council
Ms. Alawia A. Sanad , Plant Protection Directorate
Ms. Ahlam Hassan Ahmed , Plant Protection Directorate
Prof. Mutwakil A. Mahir, Agricultural Research and Technology Corporation
Mr. El Nayer Hamid Suliman, Agricultural Research and Technology Corporation
Mr. Babikir Gindeel, Rahad Agricultural Corporation
Mr. Musa Elsanousi, Blue Nile State
Mr. Eltom Abbas, Plant Protection Directorate, Blue Nile State
Mr Rashid Ali, Plant Protection Directorate, North Kordofan State

STRATEGY AND ACTION PLAN TEAM, PESTICIDES (Annex A, Part I substances)

The following people were monitoring the compilation of the pesticides related strategies and action plan

Prof. Ahmed Majoub Elhindi, Higher Council for Environment and Natural Resources
Mr. Mustafa Dukeen, Ministry of Health, National Malaria Administration

Mr. Adbelrahim Binawi, Ministry of Agriculture, National Pesticides Council
Mrs. Hala M. Elbakri, Custom Department
Mr. Imad Eldin Baheir, Ministry of Justice
Mr. Abdalla Ahmed Talab, Sudan Agrochemical Association
Mrs. Naeema Mursi, Ministry of Finance
Prof. Asim A. Abdelrahman, Sudan Environment Conservation Society
Mr. Mohamed Ali. Salama, Ministry of Agriculture and Forests
Ms. Sara Alija, UNESCO Chair for Women
Dr. Azhari O. Abdel Bagi, University of Khartoum, Faculty of Agriculture

INVENTORY, ASSESSMENT, STRATEGY AND ACTION PLAN TEAM for PCB (Annex A, Part I and Part II substances)

The activities related to the PCB were carried out by the teams formed within the National Electricity Corporation (NEC).

The teams were led by Mr. Nouery Hamid, supported by Mr. Hatim. The Ministry of Energy monitored the activity, especially the formulation of the strategy and action plans.

The key members of the five regional inventory teams were all Electrical Engineers, NEC:

Khartoum Area

Mr. Gamal Osman Hassan
Mr. Omer Mahammed Abo Zayed
Mr. Siralkhatim Abd Allateef
Mr. Suhayb Ibrahim

Central Area

Mr. Dafalla Mohammed Dafalla

Mr. Mahammed Abdalazeez

Eastern Area

Mr. Abdullah Ahmed Gorashi

Mr. Ahmed Adam Omer

Western Area

Mr. Elsadig Alnoor

Mr. Mohamed Hassan

Southern Area

Mr. Faustino Tombi
Mr. Mohammed Abo Aaglah

Northern Area
Mr. Hatim

STRATEGY AND ACTION PLAN TEAM, DDT (Annex B, Part I, II)

Mr. Mustafa Dukeen, Ministry of Health (National Malaria Control Program
Mr. Adam Ali, Ministry of Health, National Public Health Laboratories
Mr. Faiz Ministry of Health, Medical Entomology Dept. & Chemical Laboratories
Mr. Ismail Ahmed Al Kamish, Ministry of Health, Public Health Dept.),
Mr. Ahlam Ahmed, Ministry of Agriculture, Plant Protection Department,
Mr. Rehab Abdel Maged, HCENR/Ministry of Environment,
Mr. Abdel Rahim Binawi, National Pesticide Council (NPC),
Mr. Ismail Al Siddig, Agricultural Research and Technology Corporation
Ms. Naema Mursi, Ministry of Finance
Prof. Asim Ali Abdelrahman, Sudanese Environment Conservation Society
Mrs. Suaad Al tayeb, Community Development Association

INVENTORY AND ASSESSMENT TEAM for UNINTENTIONAL PRODUCTION (Annex C, Part I Chemicals and Part II and III Source categories)

Mr. Adam Ali Mohamed, National Laboratories
Dr. Adam Musa, University of Sudan for Science and Technology
Dr. Mohamed Abel Rafee, University of Khartoum, Faculty of Engineering
Mr. Mamoon Osman El Awad, Ministry of Industry
Mr. Abdel Rahman Abaker, GIAD Industrial Complex
Mr. Ismeel Ibrahim, GIAD Industrial Complex
Mr. Omer Yousif, National Electricity Corporation
Mrs Nagat Mahmoud Adam, Ministry of Industry
Miss Iptisam Osman Salih, Ministry of Industry
Miss Mariam Abdel Gafar, Khartoum State Cleaning Project
Miss Lubna Mohamed Yahya, Khartoum State Cleaning Project
Mr. Khalid Mohamed El Hassan, Khartoum State Cleaning Project
Mr. Ismeel Ahmed El Kamish, Ministry of Health
Mr. Mohamed Hamid El Nayer, Omdoman Islamic University
Mrs Aisha Abdel Rahman, Forestry Corporation

STRATEGY AND ACTION PLAN TEAM, for UNINTENTIONAL PRODUCTION (Annex C, Part I Chemicals and Part II and III Source categories)

Mr. Adam Ali Mohamed, National Chemical Laboratories
Mr. Imad Eldin Bashir, Ministry of Justice
Dr. Adam Musa Mohamed, University of Sudan for Science and Technology
Ms. Suad Eltayeb, Association for Community Development (NGO)
Mr. Sit Nour Hassan, Ministry of Health/Occupational Health Unit
Mr. Ismael El Khamish, Ministry of Health/Environmental and Public Health Unit
Ms. Rehab Abdel Mageed, Higher Council for Environment and Natural
Resources
Mr. Abdelghani Abdelgaleel, Ministry of Industry, Industry and Environment Unit
Mr. Abdelrahim Binawi, Ministry of Agriculture, National Pesticides Council
Ms. Naeema Mursi, Ministry of Finance
Ms. Sara Alija, UNESCO Chair for Women

MOHTER MILK SURVEY PROGRAMME

The activities related to the Mother Milk Survey were carried out by the National Expert Dr. Sumaia Mohmmed Elsayed, Al Ahfad University for Women

Enabling activity project coordination unit

The daily organization and operation of the Enabling activity, logistics and coordination of the National Implementation Plan work was carried out by the temporary POPs Unit at the HCENR, staffed as follows:

Coordination unit

Prof. Ahmed Mohgoub Al hindi	Technical adviser
Mr. Ali Mohamed Ali,	Project manager
Miss. Inaam Bashir Mohamed	Finance officer
Miss. Suha El Tahier	Secretary

ANNEX (3)

Members of the Multi-Stakeholder National Coordination Committee (MNCC)

	Name	Institution
1.	Hannan Mutwakil	United Nations Development Programme (UNDP)
2.	Dr. Saad Al Din Ibrahim	Higher Council for Environment and Natural Resources (HCENR)
3.	Yassin Issa	Ministry of International Cooperation
4.	Ahmed Hamed/ Nagat Awad	Ministry of Foreign Affairs
5.	Imad Al Din Bashir	Ministry of Justice
6.	Halla Al Bakri	Department of Customs
7.	Mohamed Ali Salama	Ministry of Agriculture (Irrigated Sector)
8.	Ahlam Hassan Ahmed	Plant Protection Directorate
9.	Abdel Rahem Binawi	National Pesticide Council
10.	Ismail El Kamish	Ministry of Health (Environmental Health and Food Control Administration)
11.	Adam Ali Mohamed	National Chemical Laboratories
12.	Abdel Gani Abdel Galil	Ministry of Industry
13.	Azhari omer	Prior Informed Consent (P.I.C) Focal Point
14.	Mohgoub Ali	Sudanese Chambers of Industries Association
15.	Mohamed Ali Abdel Halim	Khartoum State Public Health Corporation

16.	Asim Ali Abdel Rahman	Sudanese Environment Conservation Society
17.	Ismail Al Siddig	Agriculture Research Corporation
18.	Awd Ali Bilal	Ministry of Energy and Mining
19.	Gamaa Abdel Gadir	National Research Center
20.	Swsan Abdel Gadir	National Electricity Corporation
21.	Mustafa Dakeen	Ministry of Health (National Malaria Administration)
22.	Abdall Ahmed Talab	Sudanese Agro-chemical Association (SAGA)
23.	Magda Mohamed	Sudanese Women Association
24.	Naema Mursi	Ministry of Finance
25.	Sit Nour Hassan	Occupational Health (Ministry of Health)

INTERNATIONAL EXPERTS INVOLVED IN THE NIP COMPILATION

	Name	**Consultancy area**
1.	Risto Ojala	Provision of guidance, technical support, assessment and capacity building for focal point and coordinator unit
2.	Jan Louis Beltem	Inventory of POPs pesticides and Training
3.	Roland Erich Weber	Inventory of unintentional POPs, BAT and BEP assessment
4.	Pekka Ilari Hanninnen	Socio economic, prioritization and NIP drafting
5.	Yves Guibert	PCB inventory and training of NEC staff

NIP EDITED BY :-

PEKKA IIARI HANNINNEN

AHMED MAHGOUB ELHINDI

ASIM ALI ABD EARTHMAN

ALI MOHAMED ALI