



The World Bank
Clean Air Initiative
in Sub-Saharan African Cities

ESMAP

Joint World Bank/UNDP
Energy Sector Management
Assistance Programme



Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa

**THE CASE OF TANZANIA
ACTION PLAN**

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Foreword



This is one of four documents of a series presenting the results of studies, workshops and action plans recently undertaken for four sub-Saharan African countries (Ethiopia, Mali, Mauritania and Tanzania) on the elimination of lead in gasoline.

This document describes the work realized in Tanzania.

These four countries have the particularity of being oil importing countries without local refining capability. The transition to unleaded gasoline should therefore theoretically be easier to implement in such a context than in oil-producing or oil-refining countries.

Several technical issues (such as the definition of specifications) and regulatory issues must however be resolved in order to eliminate lead from gasoline in these countries. This is precisely the goal of the studies realized in these four oil-importing countries.

These studies and workshops are financed by The Energy Sector Management Assistance Programme (ESMAP) which plays a decisive role towards the transfer of technology and knowledge in energy sector management to governments of developing countries and of economies in transition. By bringing its own resources and expertise, ESMAP strengthens the partnership of the Clean Air Initiative in sub-Saharan African Cities.

This ESMAP contribution also allows for reaching the goal set during the Dakar conference of June 2001: the complete elimination of leaded gasoline in sub-Saharan Africa as soon as possible, at the latest by 2005.

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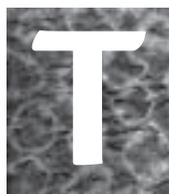
Abbreviations and Acronyms

Africaclean	NGO based in Sénégal promoting clean air activities in Africa
CNG	Compressed Natural Gas
CH ₄	Methane
CO	Carbon Monoxide
COHb	Carboxyhemoglobin
ESMAP	Energy Sector Management Assistance Program
GHG	Green House Gas
HC	Hydrocarbon
IQ	Intelligent Quotient
ILFEMP	Institutional and Legal Framework for Environmental Management
MEM	Ministry of Energy and Minerals
MTBE	Methyl Tertiary-Butyl Ether
MVCR	Motor Vehicle Central Registry, Revenue Department, Tanzania
NEMC	Tanzanian National Environmental Management Council
NO _x	Oxides of Nitrogen
NO ₂	Nitrogen Dioxide
NGOs	Non-Governmental Organizations
PM ₁₀	Particulate Matter smaller than 10 microns
PM _{2.5}	Particulate Matter smaller than 2.5 microns
PM _{1.0}	Particulate Matter smaller than 1 micron
RON	Research Octane Number
SO ₂	Sulfur Dioxide
SPM	Suspended Particulate Matter
SSA	Sub-Saharan Africa
TA	Technical Assistance
TOE	Ton Oil Equivalent
TSP	Total Suspended Particulate
µg	Micrograms
UNEP	United Nations Environment Program
TBS	Tanzania Bureau of Standards
ULG	Unleaded Gasoline
VOCs	Volatile Organic Compounds

Approx. Currency Equivalent

US\$ 1.00 = 1,000 Tanzania Shillings (Date: June, 2003)

Executive Summary



The global phase-out of lead from gasoline has proceeded dramatically in the last five years. Countries in North America, Europe, Japan and Asia have phased-out leaded gasoline; about 85% of total gasoline consumption is now lead-free. However there are a number of countries that still use lead additives to boost octane levels in gasoline. Almost all of these countries are in Africa and the Middle East. The World Health Organization recommends that leaded gasoline be phased-out worldwide.

An agreement was reached in June 2001 at the Dakar Conference, Senegal, to launch national programs to phase-out leaded gasoline by 2005 in the countries of sub-Saharan Africa (SSA).

Follow up conferences have since been held in Abuja, Nigeria in November 2001; Dakar, Senegal in March 2002; Cotonou, Benin in April 2002 and Nairobi, Kenya in June 2002. All four conferences supported the Dakar declaration. Many countries have committed to the 2005 phase out date and Mauritius has gone a step further by aiming for phase out by August 2002.

The World Bank has obtained Energy Sector Management Assistance Program (ESMAP) funding to assist Tanzania (and Mauritania, Mali and Ethiopia) to develop an action plan as described in this report, which demonstrates the benefits of leaded gasoline phase-out and outlines the necessary associated actions.

Lead is a poison with significant negative public health impacts. Historically, the principal source of atmospheric lead has been the combustion of alkyl lead additives in motor fuels. As SSA and other oil importing countries are confronted with fewer difficulties to phase out lead from gasoline than those operating national refineries for the supply of their markets, there is an opportunity to make a major environmental step forward through early leaded gasoline phase-out.

As shown in Chapter 2 of this report, while overall Tanzania's urban population appears not to have the lead exposure from gasoline estimated for other countries in the region, the urban population whose main activities are in close proximity to major roads would be likely to exhibit similar lead exposure from mobile sources. Continued economic development without lead-phase out would undoubtedly increase the likelihood of spiraling negative health impacts due to lead. These negative impacts fall disproportionately on the poorer people in urban areas.

Improved fuel quality to standards similar or equal to that used by other countries in the region will also have important economic benefits:

- ▲ Economic—facilitation of regional trade and cooperation, larger markets and economies of scale;



- ▲ Security of supplies—fuel of a suitable quality can be sourced from a range of markets/ suppliers;
- ▲ Facilitate capacity building—knowledge and skills enhancement will be increased through wide access to technical expertise; and
- ▲ Environmental—joint implementation of environmental standards with neighboring countries in the region.

In Chapter 4, rather than cost penalties, a change-over to unleaded gasoline is expected to lead to important savings to the economy and to motorists through:

- ▲ A switch to unleaded gasoline will lead to significant foreign exchange savings—a saving of at least US\$2M per year is anticipated because prices for ULG are lower than leaded gasoline in international markets;
- ▲ Changeover costs are expected to be negligible;
- ▲ The impact of unleaded gasoline on engines with soft valve seats in a small proportion of cars manufactured prior to 1980 is expected to be minor but could be compensated for by appropriate (lubricant) additives to the fuel. But additives are not recommended as they are not considered necessary; and
- ▲ Reduced maintenance costs for cars are expected.

These benefits have already been recognized by BP (Tanzania) that announced in June 2003 that it will immediately commence introducing ULG as a new grade of gasoline to the Tanzanian market.

The phase-out of leaded gasoline is but a first step in developing a more comprehensive approach to air quality management that would include actions on:

- ▲ Improving fuel quality and developing new fuel specifications;

- ▲ Upgrading the quality of vehicle imports and emission controls;
- ▲ Establishing baseline inventories of key pollutants and health effects; and
- ▲ Developing an appropriate public information or awareness campaign.

In Chapter 5 of this report, we propose three key recommendations to commence the process of leaded gasoline phase-out and to move towards a more comprehensive approach to air quality management. The three recommendations are:

- ▲ **Recommendation 1** – The Cabinet of the Government of Tanzania resolves to phase-out leaded gasoline and simultaneously introduces unleaded gasoline to the market by end 2003. All necessary legal and preparatory work will need to be completed by that time. The oil industry can then follow through with leaded gasoline phase-out by June 2004.
- ▲ **Recommendation 2** – The Cabinet of the Government of Tanzania commits to establishing a multi-sectoral stakeholder group by end 2003 consisting of senior members of government agencies, the oil industry, and civil society including Non-Government Organizations (NGOs) and consumer groups for a period of at least three years. The Tanzanian National Environmental Management Council; Division of Environment, Vice President’s Office; Ministry of Health; and Ministry of Energy and Minerals would have lead roles in its implementation. Further details of the role of individual organizations are made in Chapter 5. This multi-stakeholder group would oversee implementation of the public awareness activities and provide feedback and advice to implementation agencies. A proposed draft mandate for this group is included in

Chapter 9 – Annex C. This group should be supported by technical advice provided by member agencies and by consultant and other expert inputs.

- ▲ **Recommendation 3** – The Cabinet of the Government of Tanzania commits to developing a more comprehensive approach to air quality management by end 2003 based on the Terms of Reference (ToR) described in Chapter 10 – Annex D and recommended action plan set out in Table 5.1. The Tanzanian National Environmental Management Council/ Division of Environment, Vice President’s Office would have key roles.

The action plan recommends an integrated approach to improve air quality starting by phasing-out leaded gasoline in Table 5.1. It consists of these three key recommendations and nine supporting recommendations. The

draft of this action plan was discussed at a workshop of key stakeholders in June 2003 and comments made at that workshop have been incorporated into this final version of the action plan.

Chapter 6 of this report provides details of an indicative approach for developing a public awareness campaign to be overseen by the multi-sectoral stakeholder group – a draft mandate for this group is set out in Chapter 9 – Annex C.

The World Bank is willing to support the Government with its decision to phase-out leaded gasoline, and subsequent air quality management activities, and will seek funding support, together with other interested organizations, for needed follow up Technical Assistance (see Chapter 10 – Annex D for a Draft Outline Terms of Reference for work identified to date).

1 Why the need for this Action Plan?

1.1 Background

The global phase-out of lead from gasoline has proceeded dramatically in the last five years. Countries in North America, Europe, Japan and Asia have phased-out leaded gasoline; about 85% of total gasoline consumption is now lead-free. However there a number of countries that still use lead additives to boost octane levels in gasoline. Almost all of these countries are in Africa and the Middle East.

An agreement was reached in June 2001 at the Dakar Conference, Senegal, to launch national programs to phase-out leaded gasoline by 2005 in the countries of sub-Saharan Africa (SSA).

Follow up conferences have since been held in Abuja, Nigeria in November 2001; Dakar, Senegal in March 2002; Cotonou, Benin in April 2002; and Nairobi, Kenya in June 2002. All four conferences supported the Dakar declaration. Many countries have committed to the 2005 phase out date and Mauritius has gone a step further by aiming for phase out by August 2002

In the past decade, Tanzania has made significant progress in introducing regulations, strategies, and guidelines for various aspects of environmental management. A National Environmental Action Plan was produced in 1994 and a National Environmental Policy was adopted in 1997. In 2000, work on a National Strategy for Sustainable Development was initiated. A draft Institutional and Legal Framework

for Environmental Management (ILFEMP) has been prepared and is awaiting adoption and implementation.

Lead is a poison with significant negative public health impacts. As Tanzania and other oil importing countries are confronted with fewer difficulties to phase out lead from gasoline than those operating national refineries for the supply of their markets, there is an opportunity to make a major environmental step forward through early leaded gasoline phase-out.

The World Bank has obtained Energy Sector Management Assistance Program (ESMAP) funding to assist Tanzania (and Mauritania, Mali and Ethiopia) to develop this report and action plan to demonstrate the benefits of leaded gasoline phase-out and necessary associated actions.

The draft version of this report and Action Plan was discussed in a workshop with Tanzanian stakeholders on June 9-10, 2003. Following comments received during the workshop this final version of the report and Action Plan was prepared.

1.2 Objectives of this report and action plan

The objectives of this report and action plan are:

- ▲ To assist the Tanzania Government making the decision to stop importing leaded gasoline; and

- ▲ At the same time, raise awareness in government, industry and civil society on the need to pursue policies to improve urban air quality.

While the report concentrates on the issue of lead in gasoline and the need for leaded gasoline phase-out, this is but a first step towards a more comprehensive approach to integrated Air Quality Management (AQM). This report also discusses what the priority follow-on steps towards AQM might be.

1.3 Overview of Tanzania's economy and urban development

Tanzania's economy as measured by gross domestic product (GDP) was an estimated US\$9.34bn in 2001. In recent years the economy has been growing at around 5% per annum.

The nation's population was an estimated 34.6 million in 2002 and the average per capita income was US\$270.

Over 67% of the population lives in rural areas with most relying on subsistence farming. The capital city of Dar Es Salaam had an estimated population of 2.5 million in 2002. Tanzania's next four largest urban centers together with their populations (in 2002) are:

- ▲ Mwanza – 476,600;
- ▲ Mbeya – 266,400;
- ▲ Arusha – 282,700; and
- ▲ Tanga – 243,600.

1.4 Acknowledgements

The study team extends thanks to the members of the Tanzanian Government, who gave generously of their time at short notice during our mission to Tanzania in February, 2003. We are grateful to Mr. Bashir J Mrindoko and Mr. Prosper Victus, Commissioner and Assistant Commissioner, respectively, for Energy Petroleum Affairs; and Mr. Julius R Gashaza, Executive Engineer, Energy Petroleum Affairs; who facilitated all contacts during our visit to Tanzania. We also wish to acknowledge the generous assistance of Mr. Thomas FM Masili, Executive Secretary, Tanzania Association of Oil Marketing Companies, and of Prof. Jamidu Katima and Dr. A.K. Temu, University of Dar Es Salaam.

1.5 Study Team

The World Bank's study team¹ consists of:

- ▲ Dr Eleodoro Mayorga Alba, Lead Petroleum Economist, World Bank;
- ▲ Dr Amadou Diouf, President of the Africaclean network²;
- ▲ Lynda Osafo, Executive Director, Junior Eco-Club Organization, Ghana and member Africaclean network;
- ▲ England Rogasian Maasamba, Team Assistant, World Bank Resident Mission, Dar Es Salaam; and
- ▲ Philip Sayeg, Project Consultant.

¹ Mr Theo Macha, local consultant, assisted the team with some data collection.

² An NGO based in Senegal promoting clean air activities in Africa.

CHAPTER 2

Benefits of lead phase-out

2.1 Lead is highly toxic

Lead is a highly toxic, non-degradable, element that can result in damage to the brain, kidneys, blood, central nervous system, and reproductive system. Children who are exposed to high levels of lead may experience slowed cognitive development, reduced growth, and other health effects. Regulators in many countries are now aware of the insidious consequences of cumulative low-level exposure to lead, most notably decrements in neurobehavioral development of children (Schwela et al, 2001). In many countries, lead use in gasoline and other products (e.g. paints) has been, or is being phased-out, as a consequence of this.

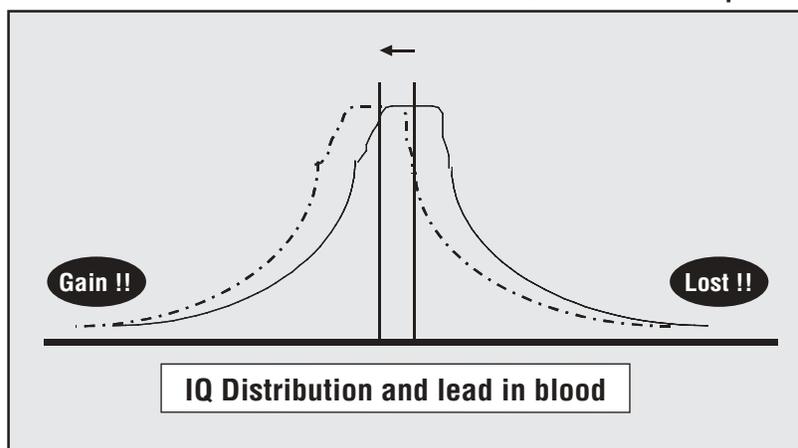
Anemic children are most vulnerable with lead more easily being able to be fixed into the bones. A loss in Intelligence Quotient (IQ) for children is a future loss in the future intelligence of the adult population that would have undesirable impacts on economic development. Figure 2.1 indicates how an average loss in intelligence implies a reduction in the capacity of society's most intelligent persons and therefore a loss in creativity.

Exposure to atmospheric lead is usually through the gastrointestinal tract as a result of consuming dust containing lead particles.

This exposure route is most important in young children, who tend to crawl and put things in their mouths. Because of a mixed and largely unplanned land use, residential dwellings, offices, shops, restaurants, schools and hospitals are usually located adjacent to major roads. This high exposure of the general population to vehicle emissions is compounded by the practice of roadside eating and walking (the majority of trips are believed to be walking trips) which increase the exposure to lead.

Atmospheric lead concentrations of 50 mg/m³ have been found in remote areas. In developed countries, where most gasoline sold is unleaded, typical annual average concentrations are between 0.1 and 0.2 mg/m³ in urban areas and between 0.01 and 0.05 mg/m³ in rural parts. Concentrations in excess of 1 mg/m³

Figure 2.1
Loss in IQ due to Lead Exposure



are recorded in cities in developing countries, which still heavily rely on leaded gasoline (Schwela et al, 2001).

The transport and distribution of lead is primarily via air. Airborne lead can be deposited on soil and water, thus reaching humans through the food chain and in drinking water. Atmospheric lead is also a major source of lead in household dust.

Potentially airborne lead can contaminate food and vegetation, water and soil with significant environmental and health impacts (Sridhar, 2001).

Historically, the principal source of atmospheric lead has been the combustion of alkyl lead additives in motor fuels. However, in countries that have not yet started phasing out lead as an antiknock agent in gasoline, most of the lead in the environment originates from vehicular emissions. In those countries, the addition of tetra alkyl lead in motor fuels accounts for an estimated 80-90% of lead in ambient air.

The degree of pollution from this source differs from country to country, depending on motor vehicle density and efficiency of efforts to reduce the lead content of petrol. In Tanzania, we understand that there are no primary or secondary lead processing and refining factories, nor any lead alkyl manufactures, lead oxide and inorganic pigments products and gray iron foundries. Hence, the main source of lead in the atmosphere in Tanzania is considered likely to originate from the use of leaded gasoline.

2.2 WHO recommends lead phase-out

As no amount of lead in the ambient air is considered safe, US-EPA does not specify maximum lead concentration in its standards as shown in Table 2.1. Although the current World Health Organization (WHO) standard for

a maximum lead concentration in the ambient air is 0.5 mg/m³, due to the significant negative impacts of lead on human health, the WHO recommended in 1995 that the use of lead additives in motor fuels be phased-out and that exposure to other sources of lead should be reduced (Schwela et al, 2001).

Table 2.1
Ambient Air Quality Standards in µg/m³

Pollutant	Averaging time	Standard or Guideline µg/m ³	
		US-EPA	WHO
TSP	Daily		– ²
	Annual ¹		
PM ₁₀	Daily	150	– ²
	Annual	50	
Lead (Pb)	1-month		
	Annual		0.5
Ozone (O ₃)	1-hour		
	8-hours		120
SO ₂	Daily	365	125
	Annual	80	50
NO ₂	1-hour		200
	Annual	100	40
CO	1-hour	40 K	30 K
	8-hour	10 K	10 K

Notes:

- ¹ Geometric mean
- ² WHO no longer recommends air quality guideline for PM because there is no safe lower limit for PM.
- Values of US-EPA are for primary standards.
- Annual Average is an average of daily measurements taken during a period of one year.
- µg/m³ is a unit of measurement and refers to one millionth of a gram of a pollutant in a cubic meter of air.
- Guideline refers to the safe level of a pollutant, for the given averaging time, to protect the public from acute health effects.
- CO values are in 1000 (K) of µg/m³.

Source: WHO/SDE/OEH/00.02, Geneva 2000.

2.3 Health impacts are growing

At present, because the Tanzanian vehicle fleet is small and the population dispersed, the impacts of airborne lead and other pollutants are likely to be low in an international context and in relation to other environmental issues.

However, the problem is concentrated in the major cities such as Dar Es Salaam where the ambient atmospheric lead and associated health problem would be larger and growing. For example, a rough estimate of the amount of urban lead exposure from gasoline for Tanzania in relation to other selected SSA or similar countries is shown in Table 2.2.

The table shows that the lead exposure in Tanzania (and Ethiopia) is expected to be lower than in neighboring Kenya or similar countries such as Ghana and Senegal. However, even though the overall lead emissions per capita in Tanzanian urban areas may be lower, for those people whose main activities take place adja-

cent to major roads, then their exposure can be expected to be similar to that observed in other countries where gasoline has a similar lead content to that used in Tanzania.

Senegal provides an interesting comparison to Tanzania—according to Table 2.2, the exposure of the urban population to lead from gasoline is much higher than in Tanzania.

In the absence of specific data on lead levels in blood in vulnerable groups in Tanzania, data from Senegal may prove instructive. A recent authoritative study carried out in Dakar, Senegal (Diouf et al 2001), showed a significant difference was observed ($p=0$) between blood lead levels observed in children living in urban areas (average 106.6 $\mu\text{g/l}$) and those living in rural areas (average 68.1 $\mu\text{g/l}$). This is the maximum level in a child tolerated by the Center for Disease Control (Atlanta, USA) since 1991. The study noted that these high levels of blood lead seem to be caused by lead from automobiles. No industries likely to emit lead

Table 2.2
Estimate of relative Lead Exposure in Selected Countries

Country	Market Share of Leaded Gasoline (%) 2002 ¹	Motor Gasoline Consumed (a) (million liters)	% of gasoline consumed in urban areas	Maximum Lead Concentration in Gasoline (gms/liter)	Average Actual Lead Concentration in Gasoline (gms/liter) ²	Actual Leaded Gas Emissions (metric tons)	Total Urban Pop (000) 1995	Exposure to Leaded Gasoline (tons per M urban 95 pop)
Ethiopia	100	188	0.70	0.6	0.06	11	8,695	0.9
Ghana	100	806	0.80	0.6	0.1	81	6,222	10.4
Kenya	100	458	0.70	0.4	0.2	92	7,763	8.3
Senegal	100	242	0.80	0.8	0.2	48	3,629	10.7
Tanzania	100	165	0.70	0.4	0.2	33	7,279	3.2

Notes:

Gasoline consumption for Tanzania and Ghana is in 2002; for other countries in 1995.

¹ Market share and fuel consumption data are for 2002 but for Kenya is 1995 data.

² Lead content for Ghana is average actual for 2001/02 (Jan 01–May 02); for Tanzania, Senegal & Kenya lead content is assumed.

Source: Adapted from WRI 2002.

into the atmosphere exist within the study area.

Diouf et al (2001) compared the results to similar studies carried out in Africa and found that the recorded blood lead concentrations were similar:

- ▲ Nriagu, 1997 carried out two studies; the first one was in Nigeria, in the medium sized town of Kaduna and the average blood lead level in children aged between 1 and 6 years old was 106 $\mu\text{g/l}$; and
- ▲ In the second study, in South Africa, covering 1,200 children aged between 3 and 10 years old, the average blood lead level of children living in urban areas was 100 $\mu\text{g/l}$ and 38 $\mu\text{g/l}$ for those living in rural areas (Nriagu, Oleru et al, 1997a Nriagu, Jinabhai et al, 1997b).

Diouf et al (2001) stated that "...the (lead) levels found in our study are very high compared to those of children living in industrialized countries. In the USA children between the ages of 1 and 6 yrs had levels of 27 $\mu\text{g/l}$ from 1991 to 1994, whereas these were 40 $\mu\text{g/l}$ in 1988 to 1991, and approximately 150 $\mu\text{g/l}$ from 1976 to 1980. In France, the average blood lead levels were estimated at 36 $\mu\text{g/l}$ in 1995 in children between 1 and 6, expecting to reach 25 $\mu\text{g/dl}$ by 2000. The reduction of average levels of blood lead in industrialized countries since the 80s is linked to the implementation of the "unleaded" policy that began earlier in the States than in France".

In conclusion, the amount of lead exposure in children in urban areas in Senegal was found to be very high. While Tanzania's urban population appears not to have the lead exposure from gasoline estimated for Senegal and the other countries shown in Table 2.2, the urban population whose main activities are in close proximity to major roads would be likely to

exhibit similar lead exposure from mobile sources.

Continued economic development without lead-phase out would undoubtedly increase the likelihood of spiraling negative health impacts due to lead. These negative impacts fall disproportionately on the poorer people in urban areas.

2.4 Economic costs of health impacts

Many studies have estimated that the economic cost of poor air quality in developing countries is significant in terms of increased mortality and morbidity and in terms of health impact (estimated between 0.5 to 2.5% of GDP).

For example in the case of Thailand, that phased-out leaded gasoline over 1992 to 1996, a recent study found that the phase-out of leaded gasoline had major health and associated economic benefits as shown in Figure 2.2.

2.5 Towards improved fuel and air quality

Air quality of a given locality is determined by the amount of emissions produced by motor vehicles and other sources as well as topography and prevailing meteorological conditions. Ambient air quality in almost all large cities in the developing world today exceeds acceptable standards and is linked to major health problems of the exposed population. Health impacts vary depending on the type of pollutant, the length of exposure and the extent of interaction with other pollutant types.

As vehicles normally contribute more than half of the emissions within an urban air shed, the phase-out of leaded gasoline that is worthwhile on its own, is an important first step in

Figure 2.2 Benefits of Unleaded Gasoline (ULG) Phase-out in Thailand

A study on health benefits after the implementation of the ULG policy showed that blood lead levels in traffic policemen decreased dramatically from 28.14 $\mu\text{g}/\text{dl}$ in 1988 to 5.33 $\mu\text{g}/\text{dl}$ in 2000. Similarly, blood lead levels in school children also decreased from 8.56 $\mu\text{g}/\text{dl}$ in 1993 to 5.58 $\mu\text{g}/\text{dl}$ in 2000. Therefore, it is obvious that the leaded gasoline phase-out policy yielded health benefits to the population in Thailand.

This study also calculated the monetary value of health benefits resulting from reductions in IQ loss effect on lifetime earnings in children, and in hypertension, heart disease, stroke and premature mortality in adults. The monetary value of health benefits was calculated to be 7,000 million Baht (US\$ 163M using an exchange rate of Thai Baht 43= US\$ 1.00 prevailing at March 03), while the costs of the phase-out are only 200 million Baht (US\$ 4.7M). Therefore, the benefits outweigh the costs by more than 32 fold.

However, the study found that lead in paint is another important challenge. Both children and traffic policemen whose blood lead levels exceed the standard have one common risk factor—exposure to house paint. Therefore, it is recommended that Thailand initiate measures to limit or remove lead from other sources, particularly paint.

Source: The Study on “Unleaded Gasoline Policy: Health Benefits for School Children and Traffic Policemen in Bangkok Metropolitan Administration” done by Chulalongkorn University and PCD, 2002.

improving overall fuel quality and hence air quality.

Although there is at present little hard evidence on the relative importance of other emissions, it appears that PM from badly tuned buses (and perhaps two-stroke motorcycles) is a growing problem. While there are clearly PM emission hotspots at street level, it is likely that ambient levels of PM are within accepted international standards. High levels of sulfur in diesel fuel are a major source of black smoke and particulate matter emissions that are very harmful to human health as described in Figure 2.3.

Apart from reducing the maximum content of lead in gasoline or eliminating lead altogether, another action that appears immediately beneficial is to reduce the level of sulfur in diesel

fuel from its present specified maximum level of 5,000 parts per million (ppm). Most developed and many developed countries are now reducing the level of sulfur in diesel fuel to a maximum of 500 ppm or lower. This 500ppm level of sulfur content compared to the present 5,000ppm specification can be achieved at relatively low incremental cost. From the point of view of an oil importing country such as Tanzania there may be no cost penalty for moving to low sulfur (500ppm) diesel.

Improved fuel quality such as introducing unleaded gasoline (ULG) and low sulfur diesel fuel pave the way for use of advanced technologies for emissions reduction in vehicle fleets. In gasoline powered engine vehicles, catalytic converters can then be introduced to reduce CO, HC and NO_x and in diesel engine ve-

hicles, the use of purifiers and filters can cut particulate and other emissions dramatically.

ULG is needed to operate catalytic converters that come as standard in modern cars. Catalytic converters reduce the tailpipe emissions of HC, CO and NO_x and pollutants emitted with engine exhaust gases. Lead not

only reduces the efficiency of the catalyst but can destroy it.

A summary of key pollutants other than lead emitted from gasoline and diesel-powered vehicles is summarized in Figure 2.3.

Table 2.3 shows that use of catalytic converters can reduce emissions of CO, VOC, NO_x

Figure 2.3 Summary of Other Key Pollutants and Health Issues

Particulate matter (PM) is a growing problem in many urban areas in developing countries. Collectively, particulate pollution is often referred to as Total Suspended Particulates (TSP). Fine particulates less than 10 and 2.5 microns in size are referred to as PM10 and PM2.5, respectively. These have the most significant impact on human health because they can penetrate deep into the lungs. PM emissions are a key health concern with estimated economic damage costs much higher than for other pollutants. Major sources of particulate pollution in urban areas are likely to be industry and commerce, re-suspension of road and construction dust, and vehicles. In non-urban areas, sources such as agricultural burning contribute significantly to overall particulate pollution, and their impacts are also felt in urban areas.

Carbon monoxide (CO) is an odorless, invisible gas, formed when carbon in fuel is not burned completely. The inhalation of CO can disrupt the supply of essential oxygen to the body's tissues—thus posing a major health risk. Those who suffer from cardiovascular disease are most at risk. At high levels of exposure, CO can be fatal. Automobiles are the largest source of CO emissions. Lesser sources include industrial processes, non-transportation fuel combustion, and natural or manmade fires.

Nitrogen oxides (NO_x), including nitrogen dioxide (NO₂), are mainly produced by fossil fuel combustion in urban areas. They play a major role in the formation of ozone, particulate matter, and acid rain. Short-term exposure, even less than three hours, to low levels of NO₂ may lead to changes in lung function in individuals with pre-existing respiratory illnesses and can increase respiratory illnesses in children. Long-term exposure to NO₂ may increase susceptibility to respiratory infections and cause permanent alterations in the lung. Diesel-powered vehicles are a major contributor to NO_x emissions.

Hydrocarbons (HC) and other Volatile Organic Compounds (VOCs)—low-molecular weight compounds cause unpleasant effects such as eye irritation, coughing and sneezing, drowsiness; heavy molecular-weight compounds may have carcinogenic or mutagenic ef-

Figure 2.3 (continued)

fects. Some hydrocarbons have a close affinity for diesel particulates and may contribute to lung disease.

Ozone (O₃) is a highly reactive gas, formed by the reaction of VOCs and NO_x in the presence of heat and sunlight. Ozone can cause a range of acute health effects including eye, nose and throat irritation, chest discomfort, coughing and headaches. Children who are active outdoors when ozone levels are high are most at risk. Ozone also affects vegetation and ecosystems, decreasing yields of commercial crops and plantations and lowering the aesthetic value of national parks.

Non-health Impacts—While health impacts are no doubt the most compelling reason to take action, non-health costs of pollution are also significant. These costs include those stemming from congestion and loss of productivity, and damage to ecosystems and physical infrastructure. Transboundary and global impacts include acid rain, global warming, and damage to stratospheric ozone.

Green House Gases—Some greenhouse gases occur naturally in the atmosphere, while others result from human activities. Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane (CH₄), nitrous oxide, and ozone. Very powerful greenhouse gases that are not naturally occurring include hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), and sulfur hexafluoride (SF₆), which are generated in a variety of industrial processes.

and CH₄ by 5 to 10 times compared to a well “tuned-up” car without a catalytic converter.

Indoor air pollution is also a potential or real problem in many urban households. Indoor air pollutants are recognized as a potential source of health risks to exposed populations throughout the world. Problems vary widely in industrialized and non-industrialized settings. In rural environments exposure to emissions from biomass burning for cooking or heating is the main problem. In urban areas such pollution can originate from cooking or heating, and be worsened by poor ventilation. Epidemiological studies have indicated that women and children who spend large portions of the day in the home are often exposed to high levels of pollutants

Table 2.3
Reduction in Gas Emissions in Vehicles
with or without Catalytic Converters

	without c.c.	with c.c.
“well tuned-up”		
CO (gm/km)	42.67	6.86
VOCs (gm/km)	5.62	0.67
CH ₄ (gm/km)	0.19	0.04
NO _x (gm/km)	2.70	0.52

Source: Eleodoro Mayorga Alba (2001)

there. In addition, the location of the home is a major determinant of total exposure. Poor outdoor pollution also increases indoor air pollution levels.

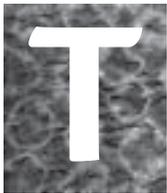
2.6 Other benefits

Improved fuel quality to standards similar or equal to that used by other countries in the region will have important economic benefits:

- ▲ Economic – facilitation of regional trade and cooperation, larger markets and economies of scale;
- ▲ Security of supplies – fuel of a suitable quality can be sourced from a range of markets/suppliers;
- ▲ Facilitate capacity building – knowledge and skills enhancement will be increased through wide access to materials and expertise; and
- ▲ Environmental – joint implementation of environmental standards with neighboring countries in the region.

CHAPTER

3 Potential cost advantages and disadvantages in lead phase-out



This section discusses a number of potential costs impacts that could potentially arise from leaded gasoline phase-out although as shown below in many cases the various cost factors are favorable to the case for leaded gasoline phase-out, or very minor.

3.1 Fuel prices – ULG is cheaper in international markets

Lead is harmful to human health and does not occur naturally in gasoline. But lead has traditionally been used in gasoline since the early 1920s as it is the cheapest means of increasing octane level. It also protected exhaust valve seats in older vehicles that were designed to operate on leaded gasoline. Both of these requirements can now be met by use of ULG which has additional, significant health benefits to the population at large (EPA, 1996; Chevron, 1990; Shell; 1990).

Since around 85% of the world's gasoline sales are now ULG, ULG is almost always cheaper to purchase on world markets.

For example, prices of gasoline (leaded and ULG) varied as follows recently in selected international markets:

- ▲ Barges FOB Rotterdam for 5 days ending Jan 31, 2003³): Premium leaded gasoline (0.15g/l) was US\$ 314 – US\$ 319/ barrel

and Premium unleaded was US\$ 315 to US\$ 317/barrel. Since a barrel is approx 162.75 liters **ULG is cheaper by US\$ 0.012/liter in this example.**

- ▲ In the Gasoline International Market, FOB NEW Premium ULG was US\$ 303 per US gallon compared to FOB Medium leaded (0.15g/liter of lead) was US\$ 310.6 per US gallon. **ULG is cheaper by US\$0.043/liter in this example.**

Fuel price quotations are stated as CIF (cost, insurance and freight) – i.e. where usually the bidder would quote the product CIF meaning that they would be prepared to sell the fuel at the price including, cost of fuel, freight and insurance to bring the goods to the named port of destination e.g. CIF Dar Es Salaam.

Given that Tanzania purchases around 165M litres of fuel per year, the foreign exchange saving to the country in purchasing ULG, compared to the leaded gasolines used in the examples, would vary between **US\$ 2.0M and US\$ 7.1M per year. This would be a major potential foreign exchange saving.**

³ According to the January 2003 edition of Platt's "Oilgram Price Report"

3.2 Change-over costs

With a single grade⁴ of gasoline (now 95RON) it is a straightforward matter to convert to ULG. After stopping leaded gasoline imports, after a suitable transition period in which all significant traces of lead are removed, a switch to ULG can immediately take place with no infrastructure costs or transition issues.

What is the length of a suitable transition period? This would be best determined by industry but is believed to require three rotations of gasoline in which all gasoline is flushed out and replaced each time by a new ULG load. In remote, up country locations one rotation would take around one or more months. Hence, a transition period of around six months would seem appropriate for tanks at Tanzania's 450 gasoline stations.

A program to flush the relevant industry-owned depots would need to be planned but would not involve any additional cost.

Overall, a carefully planned changeover to ULG could be achieved with no significant extra cost being incurred.

3.3 Suitability of Older Vehicles with Soft Valve Seats to Use ULG

While generally all vehicles manufactured worldwide since 1980 are able to use ULG without engine damage there was concern that older vehicles (with soft valve seats) may experience some problems as described above. Some models of pre-1980 European car have soft valve seats. Lead, in addition to boosting octane rating, also acts as a valve lubricant and prevents wear in engines with soft valve seats.

The chief concern in the past that has now largely been disproved has been the possibility of exhaust valve seat recession particularly when engines with soft valve seats are operated on

ULG. The possible extent of older vehicles that may have soft valve seats needs to be considered. There is almost no reliable data on the age structure of neither the vehicle fleet nor their propensity to have soft-valve seats.

At present the in-use Tanzanian vehicle fleet is estimated to be 350,000⁵ vehicles according to data from the Revenue Departments' Central Motor Vehicle Registry as set out in Chapter 11 – Annex E. Based on the proportions of cars and commercial vehicles provided by Raynor (2002) we estimate that some 154,000 are cars and are used for personal transport. It is estimated that less than 20% of cars are older than 20 to 23 years (i.e. pre-1980). The balance of the in-use fleet of 196,000 vehicles consists of commercial vehicles which use diesel fuel.

In the USA in 1970, about a third of cars had valves seats made of soft metals. It could be assumed that less than a third of vehicles manufactured between 1970 and 1980 had soft valve seats. For the purposes of this report it has been assumed that a fifth of vehicles older than 20 years in Tanzania may have soft valve seats. Applying this to the 20% of vehicles older than 20 years gives an estimate of around four percent of Tanzania's car fleet that may have soft valve seats.

In fact, as many older vehicles may have had their engine replaced by an imported Japanese or other engine as was (and is today) common practice, the estimate of four percent is thought to be on the high side.

⁴ In June 2003, BP Tanzania introduced ULG side beside their leaded gasoline in effect creating a second grade of gasoline that they agree has led to increased distribution costs.

⁵ This is more than three times the total vehicles reported by Raynor (2002) which stated that Tanzania's total car fleet was 49,500 vehicles and its commercial vehicle fleet was 63,000 vehicles giving a total of 112,500 vehicles.

But it appears that in the past, too much lead has been added to gasoline for the purposes of lubrication – only some 0.02gm/liter are needed for lubrication purposes. That is, even in older cars with soft valve seats the amount of lead required is small. Only every fourth or fifth tank need be leaded (Shell Science and Technology).

But studies by US-EPA found that the theoretical problem of valve seat recession that could occur if soft-valve seat engines use ULG is unlikely to occur. Under laboratory test conditions, it was found that some five hours of driving at 100km/hr would be required to cause the problem to start to occur and then the (old) car is likely to fail from some other problem.

Chevron (1990), a US Oil Company, has concluded that all typical US passenger cars and light-duty trucks are safe from valve recession when operated on ULG. Weaver (1996) “...concluded that much of the concern about valve seat recession in normal use has been misdirected and exaggerated”.

Radian (1994) concluded that reducing lead in gasoline is a win-win action as it will extend spark plug life, increase the interval between oil changes and extend exhaust system and muffler life. These findings have been also confirmed by US EPA (1985).

That is, recent international experience has confirmed that the potential damage to be at worst, a minor issue and to the extent that the problem exists, is able to be completely resolved by the addition of appropriate (lubricant) addi-

tives to the fuel. In Tanzania, the available evidence is that the issue of soft valve seat recession is not an issue and hence valve seat lubricating additives are not required to be added to the new ULG fuel.

Finally, many countries around the world with older car fleets similar to those in SSA countries have recently phased-out leaded gasoline without use of lead-substitute additives in ULG (e.g. Colombia, Honduras, Bolivia, and Guatemala) and no problems have been reported.

Participants from the Tanzania workshop considered that valve seat recession was a non issue in the context of Tanzania. Hence, no further action on this subject was recommended.

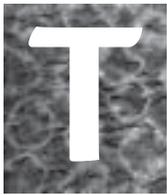
3.4 Conclusion

It is concluded that there are no significant costs involved in changeover to ULG. In summary,

- ▲ A switch to ULG will lead to significant foreign exchange savings;
- ▲ Changeover costs are expected to be negligible;
- ▲ The impact of ULG on engines with soft valve seats is expected to be insignificant and no additives to lubricate soft-valve seats are required; and
- ▲ Reduced maintenance costs for cars are expected.

CHAPTER

4 Priority issues and recommendations for leaded gasoline phase-out



The discussion of overall benefits (Chapter 2) and costs (Chapter 3) of the phase-out of leaded gasoline shows that the benefits are likely to greatly exceed the costs which are virtually nil or actually in favor of the leaded gasoline phase-out decision.

The appropriate approach to change-over to ULG involves setting a phase-out date for leaded gasoline that provides a suitable length of time to flush all traces of lead from the distribution system. A lead time of six months appears appropriate and that is the time actual importation of leaded gasoline should be banned.

It is therefore recommended that:

- ▲ **Recommendation 1** – The Cabinet of the Government of Tanzania resolves to phase-out leaded gasoline by end 2003 and simultaneously introduce unleaded gasoline to the market⁶. All necessary legal and preparatory work will need to be completed by that time. The oil industry can then follow through with leaded gasoline phase-out by June 2004.

As demonstrated in this report, the phase-out of leaded gasoline is but a first step in developing a more comprehensive approach to air quality management which would include actions on:

- ▲ Improving fuel quality and developing new fuel specifications;
- ▲ Upgrading the quality of vehicle imports and emission controls;
- ▲ Establishing baseline inventories of key pollutants and health effects; and
- ▲ Developing an appropriate public information or awareness campaign.

The issues involved in leaded gasoline phase-out and air quality improvement involve many groups in society and consequently it is recommended that:

- ▲ **Recommendation 2** – The Cabinet of the Government of Tanzania commits to establishing a multi-sectoral stakeholder group by end 2003 consisting of senior members of government agencies, the oil industry, and civil society including Non-Government Organizations (NGOs) and consumer groups

⁶ BP's recent (June 2003) introduction of ULG as a new grade of gasoline is commendable. But BP still sells leaded gasoline side by side with ULG. As BP currently purchases only small quantities of ULG and operates two distribution systems it incurs significant additional costs. It would be far more economical for the nation to reject this approach and phase-out leaded gasoline and introduce ULG in a single step.

for a period of at least three years. The Tanzanian National Environmental Management Council; Division of Environment, Vice President's Office; Ministry of Health; and Ministry of Energy and Minerals would have lead roles in its implementation. Further details of the role of individual organizations are made in Chapter 5. This multi-stakeholder group would oversee implementation of the public awareness activities and provide feedback and advice to implementation agencies. A proposed draft mandate for this group is included in Chapter 9 – Annex C. This group should be supported by technical advice provided by member agencies and by consultant and other expert inputs.

The benefits from a more comprehensive approach to air quality management are expected to be significant and it is therefore recommended that:

- ▲ **Recommendation 3** – The Cabinet of the Government of Tanzania commits to developing a more comprehensive approach to air quality management by end 2003 based on the Terms of Reference (ToR) described in Chapter 10 – Annex D and recommended action plan set out in Table 5.1. The Tanzanian National Environmental Management Council/ Division of Environment, Vice President's Office would have key roles.

These first three recommendations are considered fundamental or key recommendations. A series of important associated recommendations that flow from the above are presented below. Except where indicated the recommended actions below are believed to be cost neutral or favorable to the lead phase-out decision (i.e. save money).

4.1 Fuel specifications and fuel quality

Tanzania's present unleaded gasoline fuel specifications (contained in Chapter 8 – Annex B) have been recently updated on a regional basis and are considered satisfactory until the next regional update.

In Tanzania at present the standard for sulfur content in diesel fuel is 0.5% by weight⁷ or 5,000ppm that is quite high. This sulfur content has been specified during regional fuel specifications as Kenya's Mombasa refinery cannot economically produce diesel fuel with sulfur content lower⁸ than this. Most developed and many developing countries have specified or are considering lowering the maximum permitted sulfur levels in diesel fuel to 0.05% by weight or 500ppm or lower. Even though there are at present no measurements of air quality, as sulfur is a major contributor to smoke and PM emissions from buses and other commercial vehicles, it would appear that it would be highly beneficial to reduce sulfur content in diesel fuel at the next round of regional fuel specifications updating. However, as Tanzania is an oil importing country it may be able to source low sulfur diesel fuel on world markets for no additional cost.

Even though there is an absence of comprehensive measurements of air quality or the source of emissions it is known that Tanzania's buses and trucks are gross polluters of PM and black smoke.

⁷ Actual sulfur content is believed to be around 0.3% by weight or 3,000ppm.

⁸ Since this specification was set recently it appears that the Mombasa refinery has found that it is unable to economically produce diesel fuel with a sulfur content lower than 1,000ppm.

In the meantime, therefore, it is recommended that:

- ▲ **Recommendation 4** – oil importers be encouraged to import only diesel fuel with a sulfur content lower than 3,000ppm. At the next regional round of fuel specification updating it is recommended that the maximum specified content of sulfur in diesel be lowered as close to 500ppm as it is cost-effective to do so. In the meantime, it is recommended that oil marketers through the Tanzania Oil Marketing Association agree to proceed to supply the market with low sulfur diesel (as close to 500ppm as possible).

The present system of monitoring of fuel quality relies on pre-shipment certification of fuel. However, by the time a consumer buys fuel at a petrol station there is no guarantee of the quality of the fuel. To support the leaded gasoline phase-out decision and program of overall fuel quality improvement, it is recommended that:

- ▲ **Recommendation 5** – Tanzania’s Bureau of Standards should be given expanded powers and resources to satisfactorily monitor in-market fuel quality. This also requires TBS to have the power to apply suitable fines and penalties to act as an effective deterrent to fuel quality breaches.

4.2 Vehicle imports and emission controls

As for many other developing countries, Tanzania relies on the import of second hand vehicles to supply its vehicle markets. New vehicles are also imported but have a minor role.

Second hand vehicles have typically already done significant mileage and are usually aged between 5 and 10 years. As the source of most vehicles would be Europe most would be equipped with functioning catalytic converters when they enter the country. At present, these catalytic converters are left intact while operating in Tanzania on today’s leaded gasoline. They are therefore destroyed in-use by the lead additive.

As the Tanzanian vehicle market is price-sensitive there appears to be an exhibited preference for older vehicle imports (towards 10 years old rather than five years) with most likely poorer performance in terms of emissions.

The percentage of vehicles with soft valve seats is likely to be almost negligible and even these vehicles will under normal operating conditions be able to operate satisfactorily on ULG.

While significant benefits are to be derived from the use of ULG on its own, even greater benefits to air quality and public health will be incurred through the reduction of other emissions by the mandatory use of catalytic converters in cars. It is therefore recommended that:

- ▲ **Recommendation 6** – All cars imported into Tanzania be fitted with a functioning catalytic converter and that this is to be certified by the exporter in the country of origin, and the importer in Tanzania prior to the vehicle being registered for on road use in Tanzania;
- ▲ **Recommendation 7** – The Central Motor Vehicle Registry should not register an imported vehicle without these two certifications being present.

At present, there are no regulations governing the quality of imported new or second hand vehicles, their age or the extent of their

emissions. Tanzania's present system of reliance on second hand imports while having many benefits may need to be adjusted to ensure that over time, the quality and level of technology (which with fuel quality governs emission levels in new vehicles) in imported vehicles continue to improve.

An appropriate regulation may seek to limit the age of vehicles which can be imported to 7 or say, 10 years to ensure that over time, Tanzania's vehicle fleet is upgraded in terms of technological level. It is also recommended that:

▲ **Recommendation 8** – In the medium term (2 to 4 years) the benefits and costs of introduction of a system to reduce emissions from new and imported vehicles be developed and the options for such a system, should it be worthwhile, be evaluated and a clear recommendation made. The options would include tax changes to favor younger, low polluting vehicles and/or age limits on vehicles that can be imported. The responsible agency would be the Ministry of Finance. Other relevant agencies are the Tanzanian National Environmental Management Council; Division of Environment, Vice President's Office; and the Ministry of Communications and Transport. The World Bank will aim to facilitate Regional Cooperation in SSA to achieve a harmonization of the approaches to reducing emissions from imported vehicles.

There is no effective inspection and maintenance (I/M) system for in-use vehicles at present in Tanzania. It is recommended that:

▲ **Recommendation 9** – In the medium term (2 to 4 years) the effectiveness of the existing system of I/M be investigated and options to improve the I/M system be de-

veloped and analyzed to reduce emissions from in-use vehicles. A traditional I/M system may be difficult to sustain due to a lack of capacity—an appropriate system may consist of random checking of gross pollutants. The responsible agencies are the Tanzanian National Environmental Management Council; Division of Environment, Vice President's Office; and the Ministry of Communications and Transport.

4.3 Base line studies of emissions and health impacts

Given a decision to phase-out leaded gasoline it is recommended that:

▲ **Recommendation 10** – In order to create a suitable base-line to measure the benefits of the lead phase-out decision, statistically valid measurements of blood level lead in currently vulnerable groups (e.g. traffic policemen, school children etc) and a suitable control group, be carried out in Dar Es Salaam. The responsible agency is the Ministry of Health.

Prior to designing other interventions to reduce other pollutants, initial base line studies to establish an initial emissions inventory and the likely severity of health impacts of each pollutant will need to be developed. They will require technical assistance and this may be able to be provided by the World Bank, the United Nations Environment Program (UNEP) or other donors. The estimated cost of this activity is US\$ 100,000. It is recommended that:

▲ **Recommendation 11** – An emissions inventory from mobile and other sources be developed by the Tanzanian National En-

Environmental Management Council; and Division of Environment, Vice President's Office. The following pollutants should be targeted at first with both ambient and roadside measurements conducted at a small range of representative sites in Dar Es Salaam:

- PM_{2.5}
- CO
- HC and
- NO_x

The main agencies that should be responsible would be the Tanzanian National Environmental Management Council; and Division of Environment, Vice President's Office. The estimated cost of this activity is US\$ 500,000.

In the medium term, these agencies will require technical assistance and training to establish a functioning, embryonic monitoring system and this may be able to be provided by the World Bank and/or the United Nations Environment Program (UNEP). The World Bank will aim to facilitate Regional Cooperation in SSA to achieve a harmonized approach to air quality monitoring possibly on a sub-regional basis.

4.4 Public Awareness Campaign

The public needs to be empowered through information and education to advocate for and accept unleaded gasoline as a positive factor. Information is required for stakeholders to understand the details such as effect on vehicles, health and environment and fuel specifications. There is also the need to justify the proposed action plan to the public. It would be desirable that the public have information on the actions other sub-Saharan countries have taken to phase out leaded gasoline and its implications.

Initial visits to Tanzania indicate that there is also a general lack of information on unleaded at the government level and there are some public impressions, myths and misconceptions about the negative effects of lead on vehicles, the effect of unleaded fuel on vehicles as well as a lack of knowledge on the role of the catalytic converter, and the health effects of lead on adults and children.

Discussions have also revealed that consumers have a right to be informed. Lessons show that building the capacity in the community is a slow process but confidence can be built eventually. Confident and well informed communities enhance understanding of health risks, allays myths and misperceptions. If consumers have the correct information on the side-effects of lead that are better placed to make an informed decision i.e. going unleaded.

The decision to phase out use of leaded gasoline and subsequent actions to adopt a more comprehensive approach will be supported by a well designed approach to public awareness rising, therefore, it is recommended that:

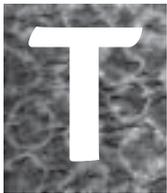
- ▲ **Recommendation 12** – A public awareness campaign, designed to inform the public, government officials, industry and others, be developed as an integral component of the decision to phase-out the use of leaded gasoline and of the subsequent actions to improve air quality on a more comprehensive basis. The recommended multi-sector stakeholder group would be overseeing this activity although it is envisaged that the Tanzanian National Environmental Management Council; and Division of Environment, Vice President's Office; and Ministry of Health could have a lead role in providing a technical secretariat certainly at the commencement of the campaign.

The broad recommended actions that correspond to this recommendation are shown in Table 5.1 of the Chapter 5. However, in Chapter 6 these recommended actions are expanded with a detailed but indicative public awareness plan that can be expected to be modified during implementation. The cost of the public awareness activity to support the lead phase-out decision and associated awareness rising

is expected to be \$100,000 in the first year of implementation with a funding commitment of \$50,000/year allocated for subsequent years. This funding would be additional and would not include relevant budgets of industry, government agencies etc for similar activities. A three-year program of public awareness rising is the minimum that should be contemplated.

CHAPTER 5

Action Plan to phase out leaded gasoline and next steps



The recommended actions presented in Chapter 4 together form the basis of an Action Plan (Table 5.1) that would move towards a more integrated approach to air quality management in

Dar Es Salaam and other urban areas, starting with the leaded gasoline phase-out decision.

Table 5.1
Action Plan for leaded gasoline phase-out and next steps

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
1.	The Cabinet of the Government of Tanzania immediately resolves to phase-out leaded gasoline by end 2003 and simultaneously supply the market with ULG. All necessary legal and preparatory work will need to be completed by that time. The oil industry can then supply ULG to the market by June 2004.		
2.	Tanzanian Cabinet commits to establishing a multi-sectoral stakeholder group by end 2003 consisting of senior members of government agencies, the oil industry, and civil society including Non-		



Table 5.1 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
	<p>Government Organizations (NGOs) and consumer groups. This group should be established for a period of at least three years. This group will need technical support provided by member agencies and other expert resources.</p>		
<p>3.</p>	<p>Tanzanian Cabinet commits to developing a more comprehensive approach to air quality management by end 2003 based on the Terms of Reference (ToR) described in Annex C.</p>		
<p>Fuel specifications and fuel quality</p>			
<p>4.</p>	<p>Oil importers encouraged to reduce the actual maximum content of sulfur in diesel to 3,000ppm or lower.</p>		<p>In the next regional round of fuel specification updates the maximum specified content of sulfur in diesel is lowered to as close to 500ppm as it is considered cost-effective to do so. In the meantime, it is recommended that oil marketers through the Tanzania Oil Marketing Association agree to proceed to supply the market with low sulfur diesel (as close to 500ppm as possible).</p>

Table 5.1 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
5.	Tanzania's Bureau of Standards should be given expanded powers and resources to satisfactorily monitor in-market fuel quality. This also requires TBS to have the power to apply suitable fines and penalties to act as an effective deterrent to fuel quality breaches.		
Vehicle imports and emission controls			
6.		All cars imported into Tanzania are required to be fitted with a functioning catalytic converter. This is certified by the exporter in the country of origin, and the importer in Tanzania prior to the vehicle being registered for on road use in Tanzania.	
7.		The Tanzanian Central Motor Vehicle Registry refuses to register an imported vehicle without sighting the export and import documents that certifies a functioning catalytic converter is present.	

Table 5.1 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
8.			<p>The Ministry of Finance in conjunction with the Tanzanian National Environmental Management Council; Division of Environment, Vice President's Office and the Ministry of Communications and Transport evaluate the benefits and costs of introduction of a system to reduce emissions from new and imported vehicles. The options for such a system (which could include taxes and age limits to favor younger low polluting vehicles), should it be worthwhile, are evaluated and a clear recommendation made. World Bank aims to facilitate Regional Cooperation in SSA to achieve a harmonization of the approach to reducing emissions from imported vehicles.</p>
9.			<p>The Tanzanian National Environmental Management Council/ Division of Environment, Vice President's Office and the Ministry of Communications and Transport assess the effectiveness of the existing system of I/M and the improvement options to reduce emissions from in-use vehicles and a clear recommendation made.</p>

Table 5.1 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
Base line studies of emissions and health impacts			
10.		The Ministry of Health develops a suitable base-line to measure the benefits of the lead phase-out decision with statistically valid measurements of blood level lead in vulnerable groups and a suitable control group in Addis Ababa. Cost: US\$100,000.	
11.	Sources of technical assistance for preparation of the emissions inventory should be considered by the Tanzanian National Environmental Management Council/ Division of Environment, Vice President's Office. These sources could include the World Bank and/or the United Nations Environment Program (UNEP).	The Tanzanian National Environmental Management Council/ Division of Environment, Vice President's Office prepares an appropriate emissions inventory from mobile and other sources. The following pollutants should be targeted: PM _{2.5} ; CO; HC; and NO _x . Cost: US\$ 500,000.	The World Bank facilitates Regional Cooperation in SSA to achieve a harmonized approach to air quality monitoring possibly on a sub-regional basis.
Public awareness campaign			
12.	Tanzanian Cabinet commits to developing a comprehensive approach to public awareness rising as further amplified in Chapter 6.	On-going consultation and activities as described in Chapter 6 (Table 6.1). Cost: Year 1: US\$ 100,000 ⁹ .	On-going consultation and activities as described in Chapter 6 (Table 6.1). Cost: US\$ 50,000/ year subsequently.

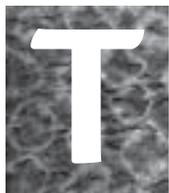
⁹ This funding would be additional and would not include relevant budgets of industry, government agencies etc for similar activities.

Table 5.1 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
	Identify sources of funding for the public awareness activity and develop initial materials as discussed in Chapter 6 (Table 6.1).		

CHAPTER 6

Indicative Public Awareness Campaign



This section of the report and action plan amplifies the details of what might constitute an appropriate approach to developing a public awareness campaign that is suitable for Tanzania. Once a commitment is made to the phase-out of lead in gasoline and to the need for a public awareness campaign, the details of the campaign can be refined to match prevailing circumstances and other proposed sub-regional programs such as that proposed by UNEP.

Creating opportunities for the participation of the public in the implementation of national action plans (through information gathering and dissemination) to phase out leaded fuel in oil importing countries such as Tanzania will help to provide information and build capacity on the health risks, legislation, partnership opportunities with various stakeholders and advocacy needed for its success.

This will in turn build capacity at community level to engage in local initiatives and interventions and to be part of a consultative group that would feed into policy and decision making in the implementation of the lead phase-out plan and air quality management plans.

It is envisaged that once a decision is made by the Tanzanian Cabinet to phase-out leaded gasoline and to commit to other actions in the Action Plan (Table 5.1), then the recommended multi-sectoral stakeholder group (A proposed draft mandate for this group is included in Chapter 9 – Annex C) would take responsibility

for overseeing the development and implementation of an appropriate public awareness campaign. This stakeholder group would need funding and the technical support of a secretariat—it is envisaged that the Tanzanian National Environmental Management Council; and Division of Environment, Vice President's Office; and Ministry of Health could play this role on a joint basis initially.

As discussed in Chapter 4 and summarized in Table 5.1, the cost of the public awareness activity to support the lead phase-out decision and associated awareness rising is expected to be \$100,000¹⁰ in the first year with a funding commitment of \$50,000/year allocated for subsequent years. A three-year program of public awareness rising is the minimum that should be contemplated.

6.1 Objectives and outputs

The objectives of a suitable public awareness campaign are:

- ▲ To sensitize and create awareness of the public on the change from leaded fuel to ULG, the health risks of car generated air

¹⁰ This funding would be additional and would not include relevant budgets of industry, government agencies etc for similar activities.



pollution and exposure to leaded gasoline, thus exposing them to the benefits to health, safety and environment.

- ▲ To assist the public to understand that unleaded gasoline will not adversely affect vehicle performance and to empower the public to enable them participate in initiatives/interventions towards the prevention and management of air pollution and the implementation of a lead phase-out plan.

The desired outputs are:

- ▲ Enhanced understanding by civil society and the creation of a well-informed public on the health risks of exposure to lead and benefits of the phase-out plan for effective decision-making;
- ▲ Public acceptance of the new fuel as a positive factor that improves air quality and thereby protects public health is ensured;
- ▲ Civil society and local communities are involved in the phase out plan and participating in initiatives to improve air quality management and control; and
- ▲ Education materials for priority issues and messages for the lead phase-out and air quality public education awareness strategy are developed/adapted.

6.2 Target audience

The target audience of the proposed public awareness campaign would include:

- ▲ Pump attendants and mechanics;
- ▲ Parents and children (local communities and schools);
- ▲ Fleet owners and operators;
- ▲ General public (motorists);
- ▲ Media people and journalists;

- ▲ Governments – policy makers/civil servants;
- ▲ Politicians;
- ▲ Members of parliament, mayors and councilors; and
- ▲ NGOs and coalitions.

It is recommended that materials for the information campaign should as far as possible be developed and shared on a regional basis in order to reduce costs and ensure uniformity. It should be community friendly, present the facts and take into account local culture.

Information should be targeted to the various groups in society such as decision makers as well as the general public.

Initially messages for the campaign should focus on health, environment and the economic benefits of unleaded gasoline.

6.3 Role of Civil society, media and other partners

The involvement of the following government and other institutions is essential to ensure the success of a public awareness campaign:

- ▲ Tanzanian National Environmental Management Council;
- ▲ Division of Environment, Vice President's Office, Tanzania;
- ▲ Tanzanian Ministry of Energy and Minerals;
- ▲ Tanzanian Bureau of Standards;
- ▲ Tanzanian Ministry of Communications and Transport;
- ▲ Tanzanian Ministry of Health/Local Government (Health inspectors/, community-based health care);
- ▲ Tanzanian Association of Oil Marketing Companies;
- ▲ Universities and colleges;
- ▲ Africaclean Network, Tanzania;

- ▲ Health Board Associations;
- ▲ Tanzania Drivers Association;
- ▲ NGO’s such as Leat, Agenda, Jet;
- ▲ Tanzania Journalists Association; and
- ▲ Oil Marketing Companies e.g. BP, Gapco, Total, Mobil, Engen, Oryx etc.

- ▲ Development Partners e.g. World Bank, (e.g. UNEP, UNDP etc)

The following stakeholders shown in Table 6.1 need to be closely involved for information sharing and support.

Table 6.1
Role of Civil society, media and other partners

Stakeholder	Role	Detail
Civil Society- NGO’s, Associations and Networks	<ul style="list-style-type: none"> ▲ Involvement/participation of local coalition NGO’s such as LEAT, AGENDA, and Networks such as Africaclean, in Information Gathering and Dissemination to facilitate broad consensus (political and social) and acceptance among stakeholders and the public. ▲ Provide information on Case studies, Conduct baseline studies, prepare fact sheets, share knowledge and expertise and sensitize during consultations to create awareness on health risks of car-generated pollution, lead in fuel, impacts of the phase-out and other successful phase-out programs. ▲ Advocacy – lobbying governments to act and monitoring compliance according to national action plans regarding fuel specs, quality enforcement and pricing. ▲ Participate in group training 	<p>Issues to include:</p> <ul style="list-style-type: none"> ▲ The elimination of lead from gasoline as the first step to improve air quality in the SSA ▲ Dispelling the myths and telling the facts about lead in fuel (and blood lead levels), that all cars can use unleaded fuel. ▲ No extra cost and cheaper on the world market ▲ That safe alternatives to lead are available ▲ Negative impacts of urban air pollution especially lead and PM on health. ▲ Vehicle imports and maintenance ▲ Participation in Local initiatives and capacity building on lead phase-out issues. ▲ Child health and environment ▲ Broad message declarations by government to phase-out lead ▲ Support statements from development partners



Table 6.1 (continued)

Stakeholder	Role	Detail
The Media	Facilitating a national media outreach to generate demand for the Unleaded fuel and support for the campaign. This includes a variety of communication channels for mass media (radio, TV, newspapers, leaflets and bill boards, press releases/conferences). They should also participate in training.	This also includes specific targeting for Dar Es Salaam and other major cities using little/group media for identified groups such as street groups/traders, mechanics, Commercial transport owners and operators, gasoline pump attendants and schools.
The Private Sector – Fuel transporters who are private owners, Haulage truck owners, Commercial Transport unions, Individuals	Advocacy and support.	Participate in training, baseline studies and other interventions.
Parents and Schools	Advocacy.	Participate in training through curriculum developed for teachers and related activities at school health centers, focusing on child health issues.
Research Institutions, University, Environmental protection Authority	Monitoring and baseline studies.	Baseline surveys—on Relevant behaviors such as usage of fuel, trends in fuel usage, issues of concern, blood lead levels and air quality. Case studies
Development Partners-WHO, UNEP, World Bank	Financial and technical support.	Funding for local initiatives, Emissions monitoring, Air Quality Baseline studies and Information dissemination.
Regulatory Agencies – Bureau of Standards Authority, Ministry of Communications and Transport	Provide technical support.	Information dissemination and materials development.

Table 6.1 (continued)

Stakeholder	Role	Detail
Government Ministries & agencies for Health, Environment, Energy and Transport, Standards	Set up multidisciplinary stakeholder steering committee on public information/ education. Participate in group training	To develop communication plan and steer public awareness activities.
Oil marketing companies/ Associations	Provide financial and technical support.	For awareness campaigns; Research-Monitoring and baseline studies; Participating in consultations; and Training programs for target groups.
Parliament	Legislation and advocacy. Participate in group training	Vehicle import tax regulations, emissions and other regulations.
Car Dealers /manufacturers – e.g. Toyota, Mitsubishi, CMC motors	Finance and Technical support	Funding for the awareness campaign Technical expertise

6.4 Emerging issues

The following emerging issues provide challenges and opportunities for developing an appropriate public awareness campaign and encouraging public participation:

- ▲ The thinking that there might be price differences or extra cost incurred by the change to unleaded gasoline. The public needs to be assured that there is no extra cost. This needs to be verified within the framework of the changes to the oil marketing arrangements anticipated after October 2003;
- ▲ The need for education about the perceived effects of unleaded gasoline on old vehicles especially when at least 20% of vehicles are over 20 years. The effect on the valve seat in older vehicles needs to be explained. It may be necessary to identify specific models of vehicles that are likely to be adversely affected by unleaded gasoline to afford a more scientific basis and help the public fully appreciate the issues including that effects are likely to be minimal;
- ▲ The concern about fuel quality and implication of current RON Levels, fuel specifications and public opinion after the change over if vehicles develop “normal” faults, etc;
- ▲ The role and benefits of catalytic converters and how to maintain their correct functioning;
- ▲ The need for discussion of options of other safe alternatives to lead as well as the advantages and disadvantages of each;
- ▲ Information dissemination on the need to minimize the health impacts of lead and other pollutants as well as impact on water quality to encourage prioritization of air quality measurements and assessments of blood lead levels. There is little informa-

tion on lead poisoning or any specific measure of the extent of the poisoning;

- ▲ Benefits of unleaded gasoline to motorists – reduced health impacts, reduced maintenance;
- ▲ Regulation on importers of old polluting vehicles; and
- ▲ The need for information of both technical difficulties in phasing out lead and social implications to the public as well as assessments of collaborative studies in countries that have phased out and those with high levels of lead in gasoline.

6.5 Indicative Public Awareness Detailed Plan

The first part of the indicative public awareness plan includes an evaluation (through baseline studies and available information) of the public’s general level of awareness of the adverse effects of lead on health as well as the level of concern and misconception about the effects of ULG. The result of evaluation and monitoring activities will provide information for the educational campaign scope (scale and costs), message content and information to be developed and/or adapted from other sources.

Table 6.2
Indicative Public Awareness Detailed Plan

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
The recommended actions in columns to right are indicative and will be modified during implementation. They flow from key overarching actions set out in Table 5.1.	Create multi-stakeholder group to oversee implementation of the public awareness activities and provide feedback for implementation agencies—identify main stakeholders and partners in air quality management and the lead phase-out activities.	Consultation on a quarterly basis with representatives of identified target groups.	Consultation on a quarterly basis with representatives of identified target groups.

Table 6.2 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
	<ul style="list-style-type: none"> ▲ Conduct a situational analysis/survey and develop a database on available information/research and evaluate public's general level of awareness of lead effects and air pollution. Develop monitoring indicators and survey tools. US\$ 10,000. 	<p>Conduct a baseline survey on relevant behaviors, public perceptions on the health risks trends of usage of fuels, perceptions on impacts on vehicle fleet, fuel specs and quality and blood lead levels.</p>	<p>Monitor impact of the campaign against indicators developed.</p>
	<ul style="list-style-type: none"> ▲ Organize consultative workshops to feedback information from the baseline research and to disseminate information on the national action plan. ▲ Identify human and material resources ▲ Organize showing of video documentary "Leaded Gasoline the silent threat" by the Clean Air Initiative (World Bank) in major urban areas. ▲ Other available documentaries, posters and materials developed by the USEPA on health impacts. 	<ul style="list-style-type: none"> ▲ Initiate mass communication and information dissemination program for targeted groups based on surveys, research, available information and materials adapted. ▲ Assess audience needs and an indication of preferred communication methods to facilitate acceptance of the new fuel and to dispel myths fears etc. ▲ Prepare ToR and issue contract for materials development and dissemination. ▲ Develop/adapt critically important messages pre-test and proceed with mass production – (prepare/adapt audio visuals, flip charts, information fact sheets. 	

Table 6.2 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
	<ul style="list-style-type: none"> ▲ Workshop to adapt / develop materials In coordination with the Ministry of Energy and Minerals, Health and other local, regional and international agencies, /stakeholders. ▲ Establish budget needs and timing. 	<ul style="list-style-type: none"> ▲ Link specific messages to identified target groups 	
	<p>Develop a communication plan for implementation including launching the program at a forum, TV/ Radio discussions on health and developmental effects caused by exposure to lead, and what to do when changing to ULG.</p>	<ul style="list-style-type: none"> ▲ Use selected communication channels under mass and other media for specific target groups and the general public (Radio, TV, Billboards, newspapers, Information services department, Flip charts, group discussions, audiovisuals, Video documentary). ▲ Actively collaborate with local agencies and other organizations doing education and awareness programs, research etc on air quality management and leaded fuel phase out (e.g. US-EPA, Alliance to End Childhood Lead poisoning, Africaclean Network, UNEP, WHO). 	<ul style="list-style-type: none"> ▲ Implementation of public awareness campaign in collaboration with stakeholders. ▲ Activities for public relations, advocacy and advertising ▲ Training, talks, seminars and forums for identifiable groups nationwide. ▲ Organize children's' programs in schools and on TV on hazards of leaded gasoline and benefits of unleaded gasoline.

Table 6.2 (continued)

Recommended Actions	Immediate	Year 1 (03/04)	Years 2 to 4 (04/05 to 06/07)
	<p>Create channels of communication for civil society input into policy and decision making</p>		<p>▲ Invite proposals for local initiatives/interventions to promote general air quality management issues and disseminate information on the phase out.</p>
		<p>Coordinate the set up of resource centers with management options (such as managed by local authorities in collaboration with civil society groups/NGO's for implementation in the capital and one other major urban center to facilitate information flow between the community and other stakeholders. Elicit consensus on future use of the center – could be open to use as reference center</p>	



CHAPTER

Annex A – Terms of Reference for Preparation of this Action Plan

Energy Sector Management Assistance Program

Improvement of the urban air quality and Phasing out of lead from gasoline in oil importing countries of sub-Saharan Africa

THE CASE OF TANZANIA

TERMS OF REFERENCE FOR CONSULTANT SERVICES

7.1 Background

Following the agreement reached at the Dakar Conference (June 2001) the ESMAP Program has allocated funds for studies required for the preparation and implementation of national and sub-regional plans to eliminate lead additives from gasoline and to contribute in this way to the improvement of urban air quality in SSA countries net importers of petroleum products.

These importing countries are confronted with fewer difficulties to phase out lead from gasoline than those operating national refineries for the supply of their markets. The studies to be made will focus exclusively on the impacts to be expected from the change of products' quality only at the level of the consumers.

Indeed, for Tanzania and also for other countries that import directly petroleum products, the studies should address the issues related to the consumer's preferences. The studies will be carried out at the same time of the setting up of a multi-organization working team gathering the different Government agencies, the oil compa-

nies and the organizations of the civil society that are interested by the formulation of recommendations to eliminate lead additives from gasoline and to continue longer term efforts to improve the quality of air in their main cities.

In 2001, Tanzania imported all of its petroleum products. Considering the prevailing price distortions, diesel is preferred in both countries by the majority of car owners. The consumption of the fishing artisan sector represents a significant percentage of the total gasoline supplied to these markets.

Tanzania does not operate refineries, as the Tanzania refinery – TIPER – was closed several years ago. The supply of petroleum products is achieved by the means of procurement operations that still considers the importation of leaded gasoline.

7.2 Objective

The main aim of the consultant services hereby requested is the formulation and implementa-

tion of a national plan for eliminating leaded gasoline from the Tanzanian fuel market as well as the review of technical, environmental and economic issues to be covered in the efforts of a network of public and private entities that is joining efforts to improve the air quality in both countries.

7.3 Scope of Work

The consultant services will cover the following topics:

- ▲ The evaluation of the current and future car fleet and the respective gasoline markets, including the fuel transportation, storage and distribution system(s).
- ▲ The analysis of scenarios of the possible evolution of the car fleet and other gasoline and motor fuels markets.
- ▲ Evaluation of the gasoline quality, octane grades and other specifications. Existing technical specs, typical imported gasoline(s) and proposed specifications.
- ▲ Possible problems of smuggling and products adulteration.
- ▲ The evaluation of the impacts of the lead and other atmospheric pollutants emissions from petroleum products.
- ▲ The identification of key stakeholders and determination of their importance and respective roles.
- ▲ Review of the legislation and regulatory measures and assessment of possible changes to reduce the air pollution (environmental regulations, vehicle importation rules, technical specifications of the petroleum products, etc). Review of the Institutional capacity to enforce regulations.
- ▲ Study of the impacts related to the replacement of the currently available gasoline(s)

for the unleaded type and proposal to reduce these impacts.

- ▲ Formulation of a national plan to improve air quality starting by the elimination of lead additives from gasoline, transition issues, evaluation of costs and benefits and preparation of a preliminary proposal for its financing.
- ▲ Proposal for the Terms of Reference and mandate of a multi-sectoral working team to implement the air quality improvement plan.
- ▲ Development of the concept for a public awareness campaign to inform on the health impacts of air pollutants starting by those from the use of leaded gasoline. Best practice campaign addressed to vehicle owners on possible measures to reduce air pollutions.

7.4 Duration of the Task

The expected net amount of time the consultant will dedicate to this task is estimated in 2.5 months to be developed during a maximum contractual duration of six months.

7.5 Consultant Qualifications

The consultant should demonstrate international experience in the preparation and implementation of programs for the elimination of lead from gasoline and related areas of work. He should be familiar with the petroleum supply procedures and markets of developing countries. He should know the typical consumer issues to be resolved when changes are carried out in their fuel supply

7.6 REPORTS

The preparation of the proposed national study will involve the following reports:

- ▲ **Field visit:** At an agreed time, the consultant will make a field visit to Tanzania. During this visit, the consultant will obtain from different stakeholders up to date information and will have the opportunity to test any preliminary recommendation to be included in the proposed national plan.
- ▲ **Inception Report:** Three weeks after the field visit, the consultant should present an inception report with the methodology that will be applied and a work program of the activities to be undertaken. This report will be commented by the local government counterparts and the World Bank.
- ▲ **Preliminary Report:** To be presented after the field visit and not later than three months after the field visit. The report will include the results and observations as well as proposals and recommendations on the issues listed in the scope of work. This report will be first commented by the local counterparts and the World Bank and in an improved version will be presented in a workshop to the different stakeholders.

- ▲ **Final Report:** After the workshop the consultant will be able to insert improvements and corrections and present its final report.

7.7 Coordination and Local Counterparts

The Ministry responsible for the energy sector and the supply of petroleum products will directly supervise the project administration and technical work. In principle The Minister will nominate a local coordinator who will assure the coordination of the parties concerned in each country (petroleum companies, consumers, local civil society members, other government agencies, etc). The resident mission of the World Bank will support the coordinator task in the organization of the field visits and the preparation of the workshops for the presentation of the consultant report.

The consultant is encouraged to make use as much as possible of local experts for activities such as data collection and partial reports on consumer's interests.

In relation to contacts with the civil society, the consultant will liaise with the network of AFRICACLEAN and the Alliance for Ending Childhood Lead Poisoning.

Declaration of Dakar Regional Conference on the Phasing-out of Leaded Gasoline in Sub-Saharan Africa

The participants from 25 sub-Saharan African countries, representing governments, industry and civil society, and from interna-

tional organizations attended the Regional Conference on the Phasing out of Leaded Gasoline (Dakar, June 26–28, 2001).

Declaration of Dakar (continued)

Considering:

- ▲ The recommendations and resolutions of WHO, WB and UNEP stating the high priority of lead phase out worldwide,
- ▲ That surveys on blood lead levels in SSA city populations show that in many cases WHO guidelines are exceeded, bringing in particular at risk children's development and intellectual performance.
- ▲ That delays to start using unleaded gasoline are precluding the introduction of vehicles equipped with catalytic converters and thus the development of urban clean air policies in growing cities of SSA.
- ▲ The support expressed by the oil industry and the NGO community in favor of a prompt government action phasing out leaded gasoline.

Agree to:

1. Join efforts to accelerate the formulation and implementation of programs to completely phase out leaded gasoline in all SSA countries as soon as possible, latest by 2005.
2. Recommend governments to reduce the lead content in gasoline—currently 0.8 g/l in most SSA countries—to average not more than 0.4 g/l by 2002 and to an average not more than 0.2 g/l by 2003.
3. Encourage countries with independent import facilities to accelerate their respective lead phasing out programs.
4. Harmonize the gasoline norms in all sub-regional markets, in order to foster intra-regional trade and traffic; and request IPIECA, in collaboration with national and international oil companies and representatives from the automobile industry, to assist in the formulation of a complete set of fuels technical specifications.
5. Complete the sub-regional action plans within the next 12 months framing the respective national clean air programs.
6. Request the oil supply chain operators to improve their production, storage and distribution facilities in accordance with the target lead phase out frame.
7. Request WHO, UNEP, WB and bilateral environmental agencies such as USEPA to support SSA stakeholders in developing the capacity to implement the lead phase out programs within air quality management.
8. Develop an appropriate public information campaign with an active participation of NGOs community.
9. Request the WB and other international donor agencies to give a high priority to lead phase out in economic policy dialogues with the SSA governments and to continue supporting required technical assistance programs and assisting in the financing of viable investments.
10. Request OAU and other regional organizations (ECOWAS, WAEMU, SADCC, CAEMU, etc.) to endorse the phasing out of leaded gasoline in their priority programs and to contribute to the harmonization of standards and technical specifications.

CHAPTER

Annex B: Overview of Tanzanian Petroleum Market



The petroleum sector in Tanzania was heavily regulated until 1997. The then sole operating refinery was the outdated TIPER refinery which refined imported crude oil into end products. It could only process around 50% of national requirements and the balance was imported by the Tanzania Petroleum Development Corporation.

In 1997, the government liberalized downstream marketing to promote competition in the petroleum sector. The government did this prior to establishing any effective oversight or regulatory function. The TIPER refinery was closed at the end of 1999.

Within a short time, some 70 companies registered as oil marketing companies. This figure included the major international oil marketing companies and many local small trading companies. Many had little experience and no storage facilities of their own. Many also are believed to have engaged in tax evasion i.e. avoiding tax on imported oil products.

At the present time, in early 2003, there are 55 registered oil marketing companies with the major ones being:

- ▲ BP
- ▲ Caltex
- ▲ Engen
- ▲ Gapco
- ▲ Gapoil
- ▲ Kobil
- ▲ National Oil

- ▲ Oilcom
- ▲ Oryx
- ▲ Shell
- ▲ Total

Many of the 55 companies are however inactive.

One grade of gasoline (95 RON) is supplied in the market. Current specifications are shown in Tables 8.1, 8.2, and 8.3 for leaded gasoline, unleaded gasoline, and gasoil, respectively. In June 2003, BP introduced ULG (95RON) to enhance its brand image as an environmentally conscious company—it did this by introducing ULG side by side with the leaded grade of gasoline. This in effect created two grades of gasoline for BP with increased costs due to operating two distribution systems.

Due to the deregulated nature of fuel prices, prices were rising rapidly at the time of writing in response to rising world oil prices. On average current prices with an exchange rate of 1US\$ = approx 1050 shillings:

- ▲ Premium gasoline – 695 shillings/liters (US \$ 0.66/ liter)
- ▲ Diesel – 660 shillings/liter (US\$ 0.63/ liter)
- ▲ Kerosene – 500 shillings/liter (US\$ 0.48/ liter)

Table 8.4 describes the price structure of retail fuel prices for diesel and gasoline in Tan-

Table 8.1
Specifications requirements for leaded gasoline, Tanzania
 Finalized Tanzania Standards TZS 579:2002; ICS.75.160.20

S/N	Characteristic	Requirements	Test Method
I	Reid vapor pressure (RVP), Kpa, max.	0.63	ASTM D 323
II	Specific Gravity 15°C	0.720–0.77	ASTM D 1298
III	Odor	Marketable	—
IV	Color	Red	Visual
V	Octane RON, min.	95	ASTM D 2699
VI	Octane MON, min.	85	ASTM D 2700
VII	Lead content (as Pb), g/L, max.	0.4	ASTM D 3341
VIII	Density at 20°C, kg/L	0.705–0.750	ASTM D 4052
IX	Existent gum content, mg/100 mL, max.	4	ASTM D 381
X	Induction period, minutes, min.	240	TZS 643
XI	Sulfur content, % mass, max.	0.2	ASTM D 1266
XII	Mercaptan sulfur, % mass, max.	0.0015	ASTM D 3227
XIII	Copper corrosion, 3 hrs at 50°C, max.	1	TZS 680
IV	Doctor Test	Negative	IP 30
XV	Distillation Recovery, °C, max.		
	(i) 10%	71	
	(ii) 50%	77–115	ASTM D 86
	(iii) 90%	180	
XVI	Final Boiling Point (°C) max.	205	ASTM D 86
XVII	Residue, % vol, max.	2.0	ASTM D 86
XVIII	20%–10% by volume evaporated, °C, min.	8.0	ASTM D 2699
XIX	Benzene, % by mass, max.	5.0	ASTM D5580
XX	Total aromatic compounds including Benzene, % by vol max.	48.0	ASTM D5580

Note: Volatility adjustment of leaded gasoline is given as follows:

20% minus 10% volume evaporated temperature °C	Allowed maximum Reid vapor pressure, bar (psi) at 100°F
8 or more	0.63 (9.1)
7.0–7.5	0.59 (8.6)
6.0–6.5	0.55 (8.0)
5.0–5.55	0.52 (7.5)

Table 8.2**Specifications requirements for unleaded gasoline, Tanzania**

Finalized Tanzania Standards TZS 672:2001; ICS.75.160.20

S/N	Characteristic	Requirements		Test Method
		Min	Max	
1	Research Octane Number (RON)	95	—	ASTM 2699
2	Motor Octane Number (MON)	85	—	ISO5163; ASTM 2700
3	Lead content g/L max.	—	0.013	ASTMD 3348
4	Benzene content %v/v	—	5.0	EN 238: 1998
5	Density at 20°C kg/m ³	725	780	TZS679: 2001
6	Distillation Point			
	a) Temperature °C for 10% v/v evaporated	—	71	ASTM D 86
	50% v/v evaporated at	77	115	
	90% v/v evaporated at	—	180	
	b) final boiling point °C	—	205	
	c) residual % v/v	—	2.0	
7	Oxidation Stability	360	—	TZS643: 2001
8	Copper strip corrosion (3hours at 50°C)	Class 1	1-strip	TZS680:2001/ISO 2160:1998, ASTM 130
9	Existence gum content solvent washed mg/100ml	—	4	ASTM 381
10	Sulfur content, % m/m	—	0.05	ISO 8754, ASTM D 1266 visual
11	Color	As per Govt requirement		

zania. Except for prescribed taxes, prices rise or fall in response to global prices.

Tanzania's Bureau of Standards while technically responsible for the standards has limited powers and capacity (e.g. equipment) to carry out in-country checks of fuel quality. The country relies on a system of pre-shipment certification which by and large is satisfactory but is not able to guarantee the quality of fuel sold to consumers. However, while fuel quality of imported fuel may generally be satisfactory, a recent confidential study¹¹ for the Tanzanian Petroleum Marketing Association found that there was no effective monitoring of imported fuel volume entering the country with a result that official fuel sales may be up to 20%

underreported with tax being avoided on this unreported fuel.

The same report found that there were some issues with mixing of kerosene and gasoline and with smuggling from Kenya along the border regions. The latter problem was regarded as relatively minor as the Tanzania Revenue Authority is a competent enforcer. There has always been some leakage across the border between Kenya and neighboring parts of Tanzania. As fuel prices in Kenya are higher (even in Nairobi they are US\$0.83 compared to US\$ 0.66 in

¹¹ A Review of the Petroleum Industry in Tanzania 2002 – Problems and Perceptions”.

Table 8.3
Specifications requirements for Automotive Gasoil (Diesel)
 Finalized Tanzania Standards TZS 674:2001

S/N	Characteristic	Requirements	Test Method	
1.	Density, 15°C	0.82–0.87	ASTM D1298	
2.	Appearance	Clear	Visual	
3.	Color, <i>max.</i> ASTM	3.5	ASTM D1500	
4.	Cetane Number, <i>min.</i>	51	ASTM D613	
5.	Cetane index. calc. <i>Min.</i>	48	ASTM D976	
6.	Viscosity, at 40°C, cSt.	1.6–4.5	ASTM D445	
7.	Cloud point, °C, <i>max.</i>	4.5	ASTM D2500	
8.	Sulfur, % by mass, <i>max.</i>	0.5	ASTM D2622	
9.	Copper corrosion 3 hrs at 100°C, <i>max.</i> (strip) or 50°C	1	ASTM D130	
10.	Carbon residue, 10% bottoms, % by mass <i>max.</i>	0.15	ASTM D189	
11.	Water, % vol. <i>max.</i>	0.05	ASTM D95	
12.	Sediment, % vol. <i>max.</i>	0.01	ASTM D473	
13.	Ash, % by mass, <i>max.</i>	0.01	ASTM D482	
14.	Flash Point PMCC, °C, <i>min.</i>	65.5	ASTM 93	
15.	Distillation Recovery, % by volume, <i>min.</i>	1.00	ASTM 86	
16.	Distillation recovery, % by volume,	At 357°C	90	ASTM D8
17.	Total volume recover % by volume	240–310°C	90	
18.	Oxidation stability mg/100 ml. <i>max.</i>	2.0	ASTM D2274	

Dar Es Salaam) it would be expected that legal importation of Kenyan fuel would not be attractive but could be done if tax-avoided Kenyan fuel could be sourced. However, smuggling from Tanzania to Kenya may occur. Fuel prices in Arusha and other towns near the Kenyan border are actually lower than in Dar Es Salaam suggesting that maybe there is smuggling across the border and tax avoidance. However, the problem is understood to be localized.

In 2002, fuel sales (retail and other) were as described in Table 8.5. Diesel fuel dominates reflecting the high proportion of commercial vehicles in the fleet (or alternatively, the relatively few cars).

Fuel imports enter the country through Dar Es Salaam and are shipped by truck up-country depots. There are 450 gasoline stations (for retail sales) of which about half are in Dar Es Salaam.

Table 8.4
Tanzanian Specified Fuel Taxes

Product	(1) Landed fuel cost	(2) Excise Duty	(3) Fuel Levy	(4) VAT (on 1+2+3)	(5) Total Tax	Retail Price (Dar Es Salaam)
Diesel	100	42.3%	30%	20%	106.4%	206.4%
Gasoline	100	47.1%	29.0%	20%	111.3%	211.1%
Kerosene	100	42.5%	0%	20%	71.0%	171.0%

Source: Finance Act

As shown in Table 8.1, the present maximum lead content is 0.4g/liter which is quite high.

The Tanzania Bureau of Standards (TBS) has promulgated new standards for leaded gasoline, unleaded gasoline, diesel and other fuels. These standards are prepared on a regional basis (i.e. East Africa consisting of Tanzania, Kenya and Uganda). The gasoline and unleaded gasoline standards are considered satisfactory until the next round of regional revisions. In respect of diesel fuel standards and their sulfur content, Kenya's Mombasa refinery which is small and requires upgrading with desulphurization units is a constraint. The regional standards for diesel fuel specify a maximum sulfur content of 5,000ppm (i.e. 0.5% by mass) but the Mombasa refinery now claims that it cannot economically produce

diesel fuel with a sulfur content lower than 1,000ppm.

With a single grade of gasoline (now 95RON) it is a straightforward matter to convert to ULG. After stopping leaded gasoline imports, after a suitable transition period in which all significant traces of lead are removed, a switch to ULG can immediately take place with no infrastructure costs or transition issues. What is the length of a suitable transition period? This would be best determined by industry but is believed to require three rotations of gasoline in which all gasoline is flushed out and replaced each time by a new ULG load. In remote, up country locations one rotation would take around one or more months. Hence, a transition period of around six months would seem appropriate.

Table 8.5
Fuel Sales by Type 1998 to 2002, Tanzania (units: liters)

Fuel Type	1998	2000	2001	2002
Gasoline 93RON (MSP)	108,606,000	164,160,924	194,307,822	164,883,000
Diesel (Gas Oil)	413,736,000	477,498,756	500,373,209	539,070,900
LPG	na	3,275,127	3,639,680	4,903,000

Source: Tanzania Association of Oil Marketing Companies

Uncertainty about the proposed upgrade of the Mombasa refinery to produce ULG in Kenya could have a potential impact on Tanzania. The existing pipeline connects Mombasa and Kisumu via Nairobi¹². While this pipeline is critical for the efficient supply of gasoline to Uganda, Rwanda, Burundi, east part of Congo and to a less extent north of Tanzania, the avail-

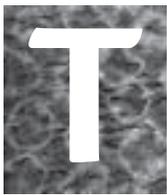
ability of this pipeline prior to the refinery being upgraded is unlikely to increase the prevalence of smuggling of gasoline product into Tanzania as described above and hence the integrity of the strategy to phase-out leaded gasoline is unlikely to be undermined by the presence of the pipeline.

¹² Up to Nairobi this pipeline is 14-inches in diameter; there onwards it is 8-inches in diameter. The 14-inch section can transport about 4.0 million tons per year, and the 8-inch section, about 1.0 million tons per year. At the moment, transportation to Nairobi is limited to about 2.4 million tons per year. Consumption in the Kisumu area in Kenya is only about 300,000 tons per year. To increase the cost effectiveness of the pipeline, another project should be developed to provide

petroleum barge loading facilities in Kisumu and a few petroleum barges to transport the products over Lake Victoria to Uganda to northwest Tanzania. With this additional transportation, about 350,000 tons per year could be delivered to Uganda and 150,000 tons per year could be delivered to Northwest Tanzania at the least cost. Source: World Bank (2003) *Sub-Saharan Petroleum Products Transportation Corridor, Analysis and Case Studies*. Draft Report.

CHAPTER

Annex C - Draft mandate for a multi-sectoral working group to oversee action plan implementation



The global phase-out of lead from gasoline has proceeded dramatically in the last five years. Countries in North America, Europe, Japan and Asia have phased-out leaded gasoline; about 85% of total gasoline consumption is now lead-free. However there a number of countries that still use lead additives to boost octane levels in gasoline. Almost all of these countries are in Africa and the Middle East. The World Health Organization recommends that leaded gasoline be phased-out worldwide.

An agreement was reached in June 2001 at the Dakar Conference, Senegal, to launch national programs to phase-out leaded gasoline by 2005 in the countries of sub-Saharan Africa (SSA).

Follow up conferences have since been held in Abuja, Nigeria in November 2001; Dakar, Senegal in March 2002; Cotonou, Benin in April 2002; and Nairobi, Kenya in July 2002. All four conferences supported the Dakar declaration. Many countries have committed to the 2005 phase-out date and Mauritius has gone a step further by aiming for phase-out by August 2002

Lead is a poison with significant negative public health impacts. As SSH and other oil importing countries are confronted with fewer difficulties to phase out lead from gasoline than those operating national refineries for the sup-

ply of their markets, there is an opportunity to make a major environmental step forward through early leaded gasoline phase-out.

The phase-out of leaded gasoline is but a first step in developing a more comprehensive approach to air quality management that would include actions on:

- ▲ Improving fuel quality and developing new fuel specifications;
- ▲ Upgrading the quality of vehicle imports and emission controls;
- ▲ Establishing baseline inventories of key pollutants and health effects; and
- ▲ Developing an appropriate public information or awareness campaign.

Government agencies will retain the key responsibilities for phasing-out leaded gasoline and its replacement with unleaded gasoline, as well as follow on actions aimed at securing a more comprehensive approach to air quality management.

As the issues involved in leaded gasoline phase-out and air quality improvement are complex and involve many groups in society and consequently it has been recommended that once the government commits to phase-out leaded gasoline and follow on actions to improve air quality, a multi-sectoral stakeholder group consisting of senior members of govern-

ment agencies, the oil industry, and civil society including Non-Government Organizations (NGOs) and consumer groups should be established.

The objectives (i.e. mandate) for this multi-sectoral stakeholder group that should be established for a period of at least three years shall be to:

- ▲ Steer the overall air quality management activities in the medium to the long term;
- ▲ Provide an independent source of advice, comment and feedback for government agencies responsible for key implementation actions for phasing-out leaded gasoline and its replacement with unleaded gasoline as well as follow on actions aimed at securing a more comprehensive approach to air quality management;
- ▲ Take responsibility for developing the public awareness campaign and associated expenditure decisions of relevant components with the close cooperation of government agencies and other groups;
- ▲ Obtain sources of funds for implementation of relevant public awareness campaign expenditures from relevant stakeholders, government and international funding agencies;
- ▲ Coordinate the relevant communication campaigns of other groups (e.g. industry,

government, media) so that a consistent message is transmitted to the public during the phase-out of leaded gasoline and its replacement with unleaded gasoline as well as follow on actions aimed at securing a more comprehensive approach to air quality management;

- ▲ Coordinate with sub-regional public awareness campaigns to ensure that messages are consistent and activities are compatible and efficient; and

The multi-sectoral stakeholder group should aim to establish a small full time secretariat within six months of being established to carry out the needed work—the secretariat should aim to supplement its resources as required with the assistance of members of the stakeholder group.

The initial steps to establish the multi-sectoral stakeholder group should be established immediately the Government commits to phase-out leaded gasoline. The initiating steps should be taken jointly by the Tanzanian National Environmental Management Council; Division of Environment, Vice President's Office; Ministry of Health; and Ministry of Energy and Minerals.

10 CHAPTER

Annex D- Draft Outline Terms of Reference for follow on air quality activities

10.1 Background

The global phase-out of lead from gasoline has proceeded dramatically in the last five years. Countries in North America, Europe, Japan and Asia have phased-out leaded gasoline; about 85% of total gasoline consumption is now lead-free. However there a number of countries that still use lead additives to boost octane levels in gasoline. Almost all of these countries are in Africa and the Middle East. The World Health Organization recommends that leaded gasoline be phased-out worldwide.

An agreement was reached in June 2001 at the Dakar Conference, Senegal, to launch national programs to phase-out leaded gasoline by 2005 in the countries of sub-Saharan Africa (SSA).

Follow up conferences have since been held in Abuja, Nigeria in November 2001; Dakar, Senegal in March 2002; Cotonou, Benin in April 2002; and in Nairobi, Kenya in July 2002. All four conferences supported the Dakar declaration. Many countries have committed to the 2005 phase-out date and Mauritius has gone a step further by aiming for phase-out by August 2002

Lead is a poison with significant negative public health impacts. As SSH and other oil importing countries are confronted with fewer difficulties to phase out lead from gasoline than

those operating national refineries for the supply of their markets, there is an opportunity to make a major environmental step forward through early leaded gasoline phase-out.

The phase-out of leaded gasoline is but a first step in developing a more comprehensive approach to air quality management that would include actions on:

- ▲ Improving fuel quality and developing new fuel specifications;
- ▲ Upgrading the quality of vehicle imports and emission controls;
- ▲ Establishing baseline inventories of key pollutants and health effects; and
- ▲ Developing an appropriate public information or awareness campaign.

Government agencies will retain the key responsibilities for phasing-out leaded gasoline and its replacement with unleaded gasoline, as well as follow on actions aimed at securing a more comprehensive approach to air quality management.

As the issues involved in leaded gasoline phase-out and air quality improvement are complex and involve many groups in society and consequently it has been recommended that once the government commits to phase-out leaded gasoline and follow on actions to improve air quality, a multi-sectoral stakeholder

group consisting of senior members of government agencies, the oil industry, and civil society including Non-Government Organizations (NGOs) and consumer groups should be established.

10.2 Objectives

The objectives of these outline draft Terms of Reference (ToR) cover needed research and technical assistance to provide a sound information base to monitor the benefits of phasing-out leaded gasoline and for supporting the design of subsequent more comprehensive activities to improve air quality generally. The objectives of the ToR are to:

- ▲ Establish an appropriate emissions inventory from mobile and other sources;
- ▲ Create a suitable base-line to measure the benefits of the lead phase-out decision through statistically valid measurements of blood level lead in currently vulnerable groups;
- ▲ Undertake a public perception survey and develop a database on available information/research and evaluate public's general level of awareness of lead effects and air pollution including develop monitoring indicators and survey tools; and
- ▲ Prepare an updated and prioritized action plan for improving air quality.

While the work required to satisfy each of the above objectives is discrete and independent to a large extent it shall be carried out under a single contract with appropriate experts being brought to bear on each separate aspect of the work.

The following sections describe the key tasks required to be undertaken to satisfy each of the above objectives.

10.3 Key tasks to satisfy each objective

10.3.1 Task 1 – Establish an appropriate emissions inventory

Establish Inventory – The purpose of this task is to support the Tanzanian National Environmental Management Council/ Division of Environment, Vice President's Office and develop an initial and approximate emissions inventory from mobile and stationery sources to support on-going air quality management activities. Initial work should be carried out to confirm the scope of the pollutants to be monitored that have been initially identified as:

- ▲ $PM_{2.5}$
- ▲ CO
- ▲ HC and
- ▲ NO_x

Both ambient and roadside measurements should be made as necessary to establish an inventory of sufficient accuracy to identify the:

- ▲ Relative contributions to each pollutant from mobile and other sources; and
- ▲ Ambient and roadside measurements over various periods of time to describe the extent to which pollutants exceed established international standards.

Propose training – Equipment used during the project shall be transferred to the Tanzanian National Environmental Management Council. They shall receive initial training towards establishing a functioning, embryonic monitoring system. The consultant should propose and carry out a suitable initial training activity recognizing that in the medium term a sub-regional approach to training could be provided by the World Bank and/or the United

Nations Environment Program (UNEP) through a program similar to their previous Global Environment Monitoring Systems (GEMS)/Air.

10.3.2 Task 2 – Create a suitable base-line to measure the benefits of the lead phase-out decision

The consultant shall propose and implement with advice of the Tanzanian Ministry of Health and the multi-sectoral stakeholder group a series of statistically valid measurements of blood level lead in currently vulnerable groups (e.g. traffic policemen, school children etc) and a suitable control group in Addis Ababa. The aim is to establish a suitable base-line to monitor blood lead levels over time.

10.3.3 Task 3 – Undertake initial public perception surveys

The purpose of the public perception surveys is to develop a database on available information/research and evaluate the public's general level of awareness of lead effects and air pollution including develop monitoring indicators and survey tools.

The consultant shall reserve US\$ 10,000 of the total budget for this technical assistance

at the disposal of the multi-sectoral stakeholder group to conduct suitable public perception surveys.

10.3.4 Task 4 – Prepare updated air quality action plan

Based on the above tasks the consultant shall prepare an updated, integrated air quality action plan that addresses in a prioritized manner the following components:

- ▲ Priority pollutants from mobile sources; and
 - ▲ Priority pollutants from stationary sources.
- The updated action plan will therefore address further priority actions on:
- ▲ Improved fuel quality and harmonized, sub-regional fuel quality specifications in the context of desirable longer term air quality improvement goals;
 - ▲ Vehicle emission standards for new and in-use vehicles;
 - ▲ Emissions reduction strategies from stationary sources;
 - ▲ Strategies for improving indoor air quality;
 - ▲ Soundly based urban and transport planning and management; and
 - ▲ Capacity building.

11

CHAPTER

Annex E- Motor Vehicle Fleet Data in Tanzania and Related Information

The following fleet statistics were obtained from the Motor Vehicle Central Registry (of the Tanzanian Revenue Department) at Dar Es Salaam. The report is for the period between 1969 to December 2002. They are cumulative vehicle registrations for this period and are believed to

over-represent the in-use fleet by at least 20 to 30%. They also overemphasize the number of vehicles present and used in Dar Es Salaam in view of its important role as the principal center of commerce in Tanzania.

Table 11.1
Vehicle Fleet Tanzania, 2002

Registration Station	No of Motor Vehicles
Arusha	25,188
Bukoba	9,998
Dodoma	4,973
Iringa	8,192
Mbeya	7,450
Kilimanjaro	9,789
Morogoro	8,513
Rukwa	1,760
Mwanza City	18,545
Mtwara	4,170
Shinyanga	2,763
Tabora	5,212
Tanga	34,776
Kigoma	2,867
Dar es Salaam City	318,921

Table 11.1 (continued)

Registration Station	No of Motor Vehicles
Government owned Parastatal Organization vehicles	3,770
Local Government vehicles	34,549
Embassies/Foreign Embassy vehicles	2,140
Total Registered Vehicles	503,576
Est. In-use vehicles (assuming 70% of registered operational)	350,000 vehicles

Notes:

1. These numbers do not include central registered cars. However, some Government vehicles were registered using ordinary registration system until as recent as December 2002.
2. It is difficult to sort out diesel and petrol vehicles because the statistics do not indicate fuel type.
3. The numbers include motorcade and tractors
4. It has been difficult to obtain the data or information because for a long time the government was only concerned with the tax revenue from importation and registration of vehicles. As of now the Government is re-registering all motor vehicles in Tanzania to create a central registry of international standards—this is expected to be ready at the end of October 2003.

Table 11.2
Taxes pertain to registration

Upon registration, any motor vehicle is charged:

▲ Car	Tshs 95,000
▲ Motorcycle	Tshs 32,000

Upon transfer, any motor vehicle is charged:

▲ Car	Tshs 55,000
▲ Motorcycle	Tshs 25,000

Registration and Transfer taxes are charged on flat rate basis whatever the age of the motor vehicle

Table 11.3
Tax structure for Vehicles in Tanzania

Type	Import Duty	Value Added Tax	Excise Duty
Saloon cars less than 3,000cc	25%	20%	—
Saloon cars more than 3,000cc	25%	20%	10%
Pick ups and lorries	10%	20%	—
Mini-buses seating less than 20 persons	10%	20%	—
Mini-buses seating less than 10 persons	25%	20%	—

12 CHAPTER

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CHAPTER 14

List of Technical Paper Series

of
Joint UNDP/World Bank
ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

Region/ Country	Activity/Report Title	Date	Number
SUB-SAHARAN AFRICA (AFR)			
Ethiopia	Phase-Out of Leaded Gasoline in Oil Importing Countries of sub-Saharan Africa: The Case of Ethiopia – Action Plan	12/03	038/03
	Sub-Saharan Petroleum Products Transportation Corridor: Analysis and Case Studies	03/03	033/03
	Phase-Out of Leaded Gasoline in sub-Saharan Africa	04/02	028/02
	Energy and Poverty: How can Modern Energy Services Contribute to Poverty Reduction	03/03	032/03
Kenya	Field Performance Evaluation of Amorphous Silicon (a-Si) Photovoltaic Systems in Kenya: Methods and Measurement in Support of a Sustainable Commercial Solar Energy Industry	08/00	005/00
	The Kenya Portable Battery Pack Experience: Test Marketing an Alternative for Low-Income Rural Household Electrification	12/01	005/01
	Phase-Out of Leaded Gasoline in Nigeria	11/02	029/02
Nigeria	Phase-Out of Leaded Gasoline in Nigeria	11/02	029/02
Senegal	Regional Conference on the Phase-Out of Leaded Gasoline in sub-Saharan Africa	03/02	022/02
Swaziland	Solar Electrification Program 2001æ2010: Phase 1: 2001æ2002 (Solar Energy in the Pilot Area)	12/01	019/01
Tanzania	Mini Hydropower Development Case Studies on the Malagarasi, Muhuwesi, and Kikuletwa Rivers Volumes I, II, and III	04/02	024/02
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Uganda	Report on the Uganda Power Sector Reform and Regulation Strategy Workshop	08/00	004/00
WEST AFRICA (AFR)			
	LPG Market Development	12/01	017/01

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Region/ Country	Activity/Report Title	Date	Number
EAST ASIA AND PACIFIC (EAP)			
Cambodia	Efficiency Improvement for Commercialization of the Power Sector	10/02	031/02
China	Assessing Markets for Renewable Energy in Rural Areas of Northwestern China	08/00	003/00
	Technology Assessment of Clean Coal Technologies for China Volume I—Electric Power Production	05/01	011/01
	Technology Assessment of Clean Coal Technologies for China Volume II—Environmental and Energy Efficiency Improvements for Non-power Uses of Coal	05/01	011/01
	Technology Assessment of Clean Coal Technologies for China Volume III—Environmental Compliance in the Energy Sector: Methodological Approach and Least-Cost Strategies	12/01	011/01
Thailand	DSM in Thailand: A Case Study	10/00	008/00
	Development of a Regional Power Market in the Greater Mekong Sub-Region (GMS)	12/01	015/01
Vietnam	Options for Renewable Energy in Vietnam	07/00	001/00
	Renewable Energy Action Plan	03/02	021/02
SOUTH ASIA (SAS)			
Bangladesh	Workshop on Bangladesh Power Sector Reform	12/01	018/01
EUROPE AND CENTRAL ASIA (ECA)			
Russia	Russia Pipeline Oil Spill Study	03/03	034/03
LATIN AMERICA AND THE CARIBBEAN (LAC)			
Ecuador	Regional Electricity Markets Interconnections — Phase I: Identification of Issues for the Development of Regional Power Markets in South America	12/01	016/01
	Regional Electricity Markets Interconnections — Phase II: Proposals to Facilitate Increased Energy Exchanges in South America	04/02	016/01
	Population, Energy and Environment Program (PEA), Comparative Analysis on the Distribution of Oil Rents (English and Spanish)	02/02	020/02
	Estudio Comparativo sobre la Distribución de la Renta Petrolera Estudio de Casos: Bolivia, Colombia, Ecuador y Perú	03/02	023/02
	Latin American and Caribbean Refinery Sector Development Report – Volumes I and II	08/02	026/02
	The Population, Energy and Environmental Program (EAP) (English and Spanish)	08/02	027/02
	Programa de Entrenamiento a Representantes de Nacionalidades Amazónicas en Temás Hidrocarbúricos	08/02	025/02

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Guatemala	Household Fuel Use and Fuel Switching	06/03	036/03
Nicaragua	Memoria Taller de Electrificación Rural	08/02	030/02
GLOBAL			
	Impact of Power Sector Reform on the Poor: A Review of Issues and the Literature	07/00	002/00
	Best Practices for Sustainable Development of Micro Hydro Power in Developing Countries	08/00	006/00
	Mini-Grid Design Manual	09/00	007/00
	Photovoltaic Applications in Rural Areas of the Developing World	11/00	009/00
	Subsidies and Sustainable Rural Energy Services: Can we Create Incentives Without Distorting Markets?	12/00	010/00
	Sustainable Woodfuel Supplies from the Dry Tropical Woodlands	06/01	013/01
	Key Factors for Private Sector Investment in Power Distribution	08/01	014/01
	Cross-Border Oil and Gas Pipelines: Problems and Prospects	06/03	035/03
	Monitoring and Evaluation in Rural Electrification Projects: A Demand-Oriented Approach	07/03	037/03

Previous Working Papers Available from the World Bank on The Clean Air Initiative in Sub-Saharan African Cities

Working Paper No. 1: Clean Air Initiative in Sub-Saharan African Cities – Dakar Seminar, December 17 & 18, 1998 - Urban Transport and Air Quality in Dakar – Proceedings (SSATP and Urban Mobility, February 1999).

Working Paper No. 2: Air Quality Studies in Urban Context – Dakar and Ouagadougou Cases – Final Reports (SSATP and Urban Mobility, September 1999).

Working Paper No. 3: Clean Air Initiative in Sub-Saharan African Cities – Work in Progress (January 2000).

Working Paper No. 4: Air Quality Study in Urban Context - Cotonou Case – Synthesis (October 2000).

Working Paper No. 5: Regional Conference on the Phase-Out of Leaded Gasoline in Sub-Saharan Africa – Dakar, Senegal, June 26–28, 2001 – Proceedings (December 2001).

Working Paper No. 6: National Conference on the Phase-Out of Leaded Gasoline in Nigeria – Abuja, Nigeria, November 15–16, 2001 – Proceedings (March 2002).

Working Paper No. 7: Sub-Regional Conference on the Phase-Out of Leaded Gasoline in Nigeria and Neighboring Countries – Cotonou, Benin, April 11–12, 2002 – Proceedings (June 2002).

Working Paper No. 8: Sub-Regional Conference on the Phase-Out of Leaded Gasoline in West Africa – Dakar, Senegal, March 26–27, 2002 – Proceedings (July 2002).

Working Paper No. 9: Sub-Regional Conference on the Phase-Out of Leaded Gasoline in East Africa – Nairobi, Kenya, June 5–7, 2002 – Proceedings (January 2003).

Working Paper No. 10: 1998-2002 Progress Report of the World Bank Clean Air Initiative in Sub-Saharan African Cities (January 2003).

Working Paper No. 11: Rapport d'avancement 1998–2002 de l'initiative sur la qualité de l'air dans les villes d'Afrique sub-saharienne de la Banque mondiale (Janvier 2003).

Working Paper No. 12: Second Steering Committee : The Road Ahead – Phase II : 2003–2006 (May 2003).

Working Paper No. 13: Phase-Out of Leaded Gasoline in Oil Importing Countries of Sub-Saharan Africa – The Case of Ethiopia, Action Plan (ESMAP, December 2003).

