TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

REINFORCEMENT AND UPGRADE OF DAR ES SALAAM, KILIMANJARO AND ARUSHA TRANSMISSION AND DISTRIBUTION SYSTEM PROJECT

ENVIRONMENTAL AUDIT OF 18 SUBSTATIONS

FINAL REPORT
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EXECUTIVE SUMMARY

1.0 Background

The demand for electric power in Tanzania has been on increase due to the growing economic and social situation in the country. Good governance, good policies, investors' confidence and economic recovery programmes have stimulated the economic growth and social activities. In 1986, Tanzania introduced and embarked on Economic Recovery Programme (ERP) backed by a series of IMF inspired structural adjustment programmes. ERP concentrated on reforming agriculture, opening up the private sectors, deregulating food marketing, liberalized trade and lifting foreign exchange controls. These programmes have resulted into urbanization and the growth in mining sector. The implication of these programmes to TANESCO has been the increase of a number of customers in major cities in need of electricity connections. However, most of the infrastructure have reached their capacities and cannot allow connection of new customers unless they are rehabilitated. The most affected are the substations and their voltage carriage lines located in Dar es Salaam, Arusha and Moshi town centres.

Tanzania's economy still faces considerable difficulties and many necessary reforms remain to be implemented. It is important then for TANESCO and the Government of Tanzania to support the industrial sector recovery by preventing frequent power outages and improve power quality. This involves putting new investment in distribution systems and development of new sources of electricity.

In Tanzania, only about 11% of the population (34million)\(^1\) enjoys the electricity. The total number of customers (residential, industrial and commerce) connected by the end of June 2005 was 570,665 with average growth of between 6-9% since year 2000.\(^2\) In terms of generation, the total available installed capacity is 890MW. The sources include TANESCO (590MW), SONGAS (200MW), and the Independent Power Tanzania Limited-IPTL (100MW). TANESCO also imports power from Uganda and Zambia for Kagera region and Tunduma, Sumbawanga and Mbozi towns respectively.

TANESCO has a number of substations scattered all over the country. Some substations are for the stepping-up from e.g. 11kV to 220kV using 11/33/66/132/220kV conversion transformers and some are step-down substations which reduce the transmission voltage into distribution voltage, say from 220kV to 11kV. This environmental audit study was conducted on some step down substations ranging from 220/132/33kV to 33/11kV.

In 2002, TANESCO in collaboration with Japanese International Cooperation Agency (JICA) prepared a Master Plan to improve the power systems in major towns of Dar es Salaam, Kilimanjaro and Arusha. The current power demands for these regions are on average 240MW, 30MW and 38MW respectively.\(^3\) The Master Plan outlines areas of priority and investments needed to solve the frequent power outages experienced in major cities. Further, TANESCO

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\(^1\) 2002 census
\(^2\) source TANESCO
\(^3\) Source TANESCO, data up to May 2005
undertook several studies including Relief Project 2 done by NetGroup Solutions (Pty) Ltd of South Africa in 2004 and feasibility study on the Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution system done by Lahmeyer International of Germany in September 2004. All these studies identified areas of priority and type of investment needed by TANESCO to improve the transmission and distribution systems.

Based on the above-mentioned studies, TANESCO consulted various financiers to seek assistance in implementing different components of the Master Plan. The World Bank (WB) as one of the contacted financiers showed interest in supporting TANESCO in that respect. Hence TANESCO and the International Development Association (IDA)/World Bank are currently preparing a distribution rehabilitation and transmission reinforcement component as part of the Songo Songo Gas Development and Power Generation Project (Credit 3569-TA). The amount under discussion with the WB is about US$ 57 million.

2.0 The Project

The proposed project to be owned by TANESCO and co-financed by the World Bank and the Nordic Development Fund (NDF) at an estimated cost of 70m USD consists of two components: The first component involves the rehabilitation of 18 existing substations at Oyster Bay, Mikocheni, Msasani, Factory Zone I, Factory Zone II, City Centre, Factory Zone III, Sokoin, Kurasini and Ilala in Dar es Salaam. Others are Mount Meru, Unga Ltd., Kilt Ltd, Them and Njiro in Arusha and Boma-Mbuzi, Trade School and Kiyungi in Kilimanjaro region. These 18 substations out of all substations in Dar es Salaam, Arusha and Kilimanjaro have been selected for the rehabilitation because they are located in the areas with fast growing power demand and the systems have reached the capacity limit hence they are overloaded. Further there will be a repair and upgrade of the 11/33 kV distribution systems. This rehabilitation of Distribution Facilities involves:

- Supply and installation of 22 additional 15MVA, 33/11kV transformers to relieve the overload in the existing substations (i.e. replacing low capacity transformers e.g. 5MVA with medium capacity of 15MVA transformers)
- Supply and installation of about 33, 33/11kV circuit breakers and 124 11kV circuit breakers with associated switchboards
- Supply and installation of 50MVA 132/33kV transformer with a circuit breaker at Kiyungi, Njiro, and Kurasini Substations.
- Supply of materials and equipment for repair/upgrading of the distribution systems which make a provision for the following: reconductoring, protection systems, auto-reclosers and auto load break switches, SCADA, section analysers, boosters, lightening protection, distribution transformers, new 33/11kV lines and statistical metering

Upgrading of substations means replacement of power transformers by a higher rated power transformer and its associated breakers. This will involve mainly upgrading of the foundations to a higher bearing capacity, thus necessitating having temporary measures in place to avoid power outages.

- The second component involves the construction of new 132kV transmission lines that will connect the Ubungo Main substation with upgraded 132/33kV Oyster Bay, Kurasini,
2.1 Project Objectives
The project will achieve the following objectives:
- Reducing the duration and frequency of power interruptions
- Improving voltage conditions at consumers’ premises
- Reducing the power system losses
- Improvement in marketing by facilitating the possibilities of connecting more customers
- Improvement of TANESCO image to the public (less complains from customers)
- Attraction of more revenue for the company
- The project will contribute to the effort by the Tanzanian Government of improving the livelihood of ordinary Tanzanians through the National Strategy for the Growth and Reduction of Poverty in Tanzania (MKUKUTA)

Component 1 of this project requires a comprehensive Environmental Audit Assessment (EAA) which is reported in this report while component 2 has separate comprehensive reports namely; Environmental Impact Assessment (EIA and SIA) and Resettlement Action Plan (RAP).

3.0 The Purpose of the Environmental Audit Assessment

World Bank requires that all investments comply with the World Bank Safeguard Policies and Environmental Guidelines as presented in the Pollution Prevention and Abatement Handbook (1998) and IFC Environmental Guidelines. It is also a Tanzanian requirement that all projects should undertake the Environmental Assessment before the implementation. The Tanzanian Environmental Management Act (2004) section 81(1-4) stipulates that it is the obligation of the project proponent to undertake environmental impact assessment study of the project.

Hence, for this study the following major guidelines and policies will be applied: Electric Power Transmission and Distribution guidelines (IFC), Occupational Health & Safety (IFC), and Natural Habitat (OP 4.04) because of potential oil pollution. Additionally, national requirement as reflected in various Tanzania’s sectoral policies, the National Environment Management Council (NEMC) Environmental Impact Assessment Guidelines (2002 update) and the Environmental Management Act (2004).

The purposes of the Environmental Audit Assessment are:
- To identify present inadequacies in environmental management, and occupational health and safety issues in the facilities to be rehabilitated. Of particular interest are the present pollution if any and its potential clean-up costs
- To determine the need for remedial actions necessary to bring the subject facilities into compliance with World Bank Safeguard Policies and
- To recommend actions to be taken to improve and strengthen TANESCO’s environmental, health and safety management
3.1 Scope of Work
The Environmental Audit Assessment focused only on the 18 existing substations earmarked for rehabilitation in Dar es Salaam, Arusha and Kilimanjaro as outlined above plus one additional substation at Chalinze in Coast Region. The Audit took place in November and December 2004.

4.0 Methodology and Approach
To accomplish the audit assessment the following approach was applied:

4.1 Reviewing records and relevant documents
All available relevant in house documents were reviewed. The documents include: the Master Plan Study on the Power Sector for Major Towns in the United Republic of Tanzania (2002) by EPDC of Japan; Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System Feasibility Study Report (2004) by Lahmeyer International; Environmental Management Act (EMA -2004); NEMC’s Environmental Guidelines (2002); various Tanzanian sectoral policies; World Bank Operational Policies; World Bank, (IFC) Pollution Prevention and Abatement Handbook; environmental and occupational health and safety guidelines and standards. These documents formed a foundation of conducting this environmental audit through a checklist.

The checklist identifies issue as per the following criteria as deduced from the guidelines mentioned above.

- General environmental management;
- Waste management practices;
- Hazardous materials management;
- Groundwater and soil contamination control;
- Occupational health and safety management; and
- Noise management (Noise level measurements were taken in some substations to get an overview of the noise levels in the substations)

4.2 Site Observations and Interview
All 18 substations in Dar es Salaam, Kilimanjaro and Arusha were visited for assessment plus an additional one at Chalinze. Consultations with NEMC and Municipal authorities were made before the site visit. Also during the site visit, interviews and brief meetings with relevant staff and residents around the substations were conducted.

4.3 Use of secondary data
Due to resource constraint, this assessment used available data and laboratory test results for identifying polychlorinated biphenyls (PCB) in transformers and switchgears conducted by previous studies in the same substations. The studies include Situation Assessment and Environmental Audit, Power Sector Restructuring Project- Final Report Version 2.0 prepared by Stone & Webster Consultants, May 2004 and Inventory of Electrical Equipment Suspected to Contain Polychlorinated Biphenyls (PCBs) prepared by the Vice Presidents Office June 2004.

4.4 PCB identification methods
The PCBs identification methods used in this study include:
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Manufacturer's nameplate information; Elimination method cut off year assumed 1980; Density test; Chlorine frame test; Dexsil test kits; and Laboratory testing (gas chromatography with electron capture then comparing results against standard chromatograms for known arochlor).

Transformer found to contain concentration of less than 50ppm of PCB was classified as PCB free. Equipment found to have 50ppm or above but below 500ppm was classified as contaminated. Equipment found to contain 500ppm and above of PCBs is classified as pure PCB.

4.5 Findings evaluation
Through field observations, site screening tests, laboratory analysis, checklist and professional judgment the audit findings were evaluated and prioritized as of high, medium or low concern depending on the severity of the problem and health, safety or environmental impact it may cause.

5.0 Report format
This environmental audit report comprises of five chapters, introduction of the project and methodology; legal framework; baseline information and the audit findings; environmental management plan & monitoring; and conclusion and recommendation. The report has appendices that include location map of substations, photo documentation, PCB laboratory results of some substations, the criteria checklist of audited substations and list of consulted people.

6.0 Public Concern
The major public concern was a health risk due to electromagnetic effect. No noise complains or concerns were reported during the survey.

7.0 Remedial Costs
The identified weaknesses are small and could be covered in region's repair and maintenance budgets. Regions need to provide the remedial budgets as appropriate so that the costs are included in the annual budgets for approval.

Note: Laboratory analysis of the soil samples under the transformers suspected of PCBs is awaiting the budget. When budget is secured soil samples will be sent for the laboratory analysis.

8.0 Training Needs
It is proposed that as part of this project, training should be considered focusing on capacity building of the environmental unit in areas of Environmental Audit, Social Impact Assessment & management, health and safety awareness seminars and work procedures for Substation engineers, technicians and operators. The anticipated cost for the training and equipment for the year 2006 is about USD 69,300.

9.0 Environmental Management Plan (EMP)
Environmental Management Plan (EMP) and monitoring have been included. EMP has identified environmental impacts and their mitigation measures. Monitoring plan has stipulated indicators to be monitored and required resources to ensure that mitigation measures are implemented. It important that TANESCO provide resources estimated to be USD 11,000 annually to implement the EMP as shown on the plan.
10.0 Major Audit findings and Recommendations

Below are the recommendations following the audit findings. Correction of these observed weaknesses and shortcomings is important so as meet the minimum World Bank requirement:

**High Priority**

1. TANESCO should ensure that transformers identified having PCB contamination (below 500ppm) are not moved from where they are located. In addition substation engineers should ensure that there is no leakage to the soil or water. Further there should be appropriate oil handling at all times while waiting for the national strategic plan to eliminate POPs prepared by the Vice Presidents Office (VPO)

2. Although training has been taking place in TANESCO, trainings specifically designed for substation engineers, technicians and operators have been scarce and limited to very few individuals. TANESCO (Head office which coordinates employees' trainings in cooperation with regional offices) needs to organise regular courses (tailor made training programs) to suit different cadres of substation employees and others. such as training may include work procedures, health and safety matters, hazardous material handling and emergency preparedness and response.

3. Since it was observed that no clear identification of who has been assigned responsibility of taking care for the environmental matters of the substations. Therefore, substation engineers or supervisors should be assigned also such a responsibility and required to report performance in monthly reports.

4. Waste management need to be improved in all the substations as this was seen to be a problem in most substations. Substation management should designate special areas (points) for waste collection before safe disposal. Special bins can be used to store collected wastes such as pieces of cables, insulators and other wastes in the substation site before disposal.

5. Raise awareness of people working in the substation on the potential hazard of oil spill to the environment and how to handle it appropriately during refilling, oil filtering or maintenance.

6. TANESCO Regional Offices are required to provide toilets and askari kiosk facilities in the substations for the convenience of workforce. There are some which need repair and some which need to be constructed. With exception of Njiro, Kiyungi, Ilala, and FZ III all other substations lack toilet, askari kiosk or both.

7. TANESCO (Regional Offices) should collect all old transformers dumped at substation sites which some of them have oil leakage and dispose them or store them in appropriate designed areas that may contain or prevent the oil leakage into the soil.

8. TANESCO should provide adequate fire fighting equipment in a right proportion (foam, CO₂ and powder) to fight any fire type in the substations and ensure that equipment are regularly checked to be sure that they are working properly. Some substations had inadequate fire fighting equipment or right proportion.
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

9. TANESCO should provide resources estimated at least USD 11,000 annually to facilitate implementation of the proposed ESMP and monitoring plan. Other mitigation costs will be covered in construction costs.

10. TANESCO Regional Offices should budget and urgently replace all lost or broken lids and slabs to improve the safety in the substations as some of the cable trench slabs were found broken or missing increasing a safety risks at night and in emergency cases.

11. TANESCO’s substation engineers in collaboration with their Regional Offices should reequip the First aid kits as required since most of first aid kits are not equipped with essential drugs.

12. TANESCO should ensure that fences are repaired, security lights working again and all danger signs replaced to alert people of the potential dangers as they approach the fences.

Medium Priority

13. TANESCO needs to prepare an emergency response plan in the event of fire, major accident or major oil spills. All audited substations didn’t have the plan. Workers need to rehearse and understand the information flow in case of the emergency so as to check whether the plan works as intended. Information flow charts should also be posted at a visible place.

14. Since TANESCO has so far no formalized Environmental Management System (EMS) in spite of having an environmental unit, which deals with environmental matters. Then TANESCO has to develop an EMS suitable to its activities or adopt ISO 14000 standard in order to improve its environmental management performance. In addition, fund for implementing management plans should be made available.

15. TANESCO should strengthen environmental management both at Head Office Environmental Unit and at the implementing Regions or plants.

16. TANESCO departments and substation engineers should prepare work procedure manuals and instructions where such instructions are very essential and make them available in a known language to all substation workers. Many substations had no working procedures and instructions at all or had instruction written in a language not understandable by majority.

Overall TANESCO Management Response

TANESCO acknowledges the corporate responsibility and shall take corrective measures of the identified environmental and health aspects. The work and budget will be included in the company’s business plan and eventually incorporated in the Company Environmental Management System (EMS).

TANESCO is committed to follow the country’s policies and continue to communicate with relevant sectors and ministries to ensure that environment is protected and health and safety of workers and people around our facilities is guaranteed.
Acknowledgement

We would like to thank Directorate of Corporate Planning and Research for resources guidance and facilitation to the success of this Environmental audit study.

We also like to acknowledge the constructive inputs and advice we received from the National Environment Management Council (NEMC) beginning with ToR preparation to the Multi sectoral Technical Review Committee meeting.

We thank TANESCO Regional Managers Mr. Masasi, C. L. (Arusha), Mr. Richard Nsulau (Kilimanjaro), Ms Eva Fumbuka (Kinondoni North), Mr. Kalokola M. (Ilala) and Mwaisaka N. (Temeke) for their consultation time and assistance whenever we asked them. We also thank their staff of all levels who participated in one way or another in the Environmental Audit exercise.

Cooperation and assistance rendered by various staff of Municipal Councils of Arusha, Moshi, Kinondoni, Ilala, and Temeke is highly appreciated.
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ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AC</td>
<td>Air Conditioning</td>
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<tr>
<td>BOD</td>
<td>Biological Oxygen Demand</td>
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<td>CBD</td>
<td>Convention on Biological Diversity</td>
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<td>CFCs</td>
<td>Chlorofluorocarbons</td>
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<td>COOPs</td>
<td>Code of Operating Practice</td>
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<tr>
<td>dB</td>
<td>Decibel – a unit for noise level</td>
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<td>EAA</td>
<td>Environmental Audit and Assessment</td>
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<td>EIA</td>
<td>Environmental Impact Assessment</td>
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<td>EMA</td>
<td>Environmental Management Act</td>
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<td>EMP</td>
<td>Environmental Management Program (Plan)</td>
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<td>EMS</td>
<td>Environmental Management System</td>
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<td>EPP</td>
<td>Emergency Power Project</td>
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<td>ESAMP</td>
<td>Environmental and Social Assessment Management Plan</td>
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<td>FZ</td>
<td>Factory Zone</td>
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<td>IDA</td>
<td>International Development Agency</td>
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<td>IDO</td>
<td>Industrial Diesel Oil</td>
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<td>International Finance Company</td>
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<td>Independent Power Tanzania Limited</td>
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<td>International Safety Rating System</td>
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<td>Japanese International Cooperation Agency</td>
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<td>Kilimanjaro International Airport</td>
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<tr>
<td>kV</td>
<td>kilo Volts</td>
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<tr>
<td>MVA</td>
<td>Mega Voltage Amperes</td>
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<td>MW</td>
<td>Mega Watts</td>
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<td>National Environmental Policy</td>
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<td>OCB</td>
<td>Oil Circuit Breaker</td>
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<td>OHSMS</td>
<td>Occupational Health and Safety Management System</td>
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<td>OP</td>
<td>World Bank Operating Policy</td>
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<td>PCBs</td>
<td>Polychlorinated biphenyls</td>
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<td>PEP</td>
<td>Provisional Environmental Permit</td>
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<td>POPs</td>
<td>Persistent Organic Pollutants</td>
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<td>PP</td>
<td>Personal Protective</td>
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<td>ppm</td>
<td>Part per million</td>
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<td>Resettlement Action Plan</td>
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<td>Safety Health and Environment</td>
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<td>Social Impact Assessment</td>
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<td>T/L</td>
<td>Transmission line</td>
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<td>Tanzania Electric Supply Company Limited</td>
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<td>TDS</td>
<td>Total Dissolved Solids</td>
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<table>
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<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tr>
<td>TQM</td>
<td>Total Quality Management</td>
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<td>TRC</td>
<td>Technical Review Committee</td>
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<tr>
<td>TSS</td>
<td>Total Suspended Solids</td>
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<td>UDSM</td>
<td>University of Dar es Salaam</td>
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<td>VPO</td>
<td>Vice President's Office</td>
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<td>WB</td>
<td>The World Bank</td>
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<td>WHO</td>
<td>World Health Organization</td>
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ARUSHA AND KILIMANJARO SUBSTATIONS NETWORK

LEGEND

Existing

- 33kV SS
- 66kV SS
- 132kV SS
- 220kV SS

Proposed, On Going

- 33kV TL
- 66kV TL
- 132kV TL
- 220kV TL
Chapter 1

Introduction

1.0 Background
The demand for electric power in Tanzania has been on increase due to the growing economic and social situation in the country. Good governance, good policies, investors' confidence and economic recovery programmes have stimulated the economic growth and social activities. In 1986, Tanzania introduced and embarked on Economic Recovery Programme (ERP) which concentrated on reforming agriculture, opening up the private sectors, deregulating food marketing, liberalized trade and lifting foreign exchange controls. The ERP was later replaced by a three year plan called the Economic and Social Action Plan (ESAP) backed by a series of IMF inspired structural adjustment programmes. These programmes have resulted into urbanization and the growth in mining sector. The implication of these programmes to TANESCO has been the increase of a number of customers in major cities in need of electricity connections. However, most of the infrastructure have reached their capacities and cannot allow connection of new customers unless they are rehabilitated. The most affected are the substations and their voltage carriage lines located in Dar es Salaam, Arusha and Moshi town centres.

Further more, Tanzania's economy still faces considerable difficulties and many necessary reforms remain to be implemented. The industrial sector being in the process of recovery, suffer from frequent power outages and deterioration of power quality (under voltage) caused by the ageing infrastructures in spite of the rectification efforts taken so far by TANESCO and the Government of Tanzania. This system overload experienced in many substations and distribution network needs urgent improvement in terms of new investment in distribution systems and development of new sources of electricity if TANESCO is to continue to serve its customers with quality power and connect new customers.

In Tanzania, only about 11% of the population (34million)\(^1\) enjoys the electricity. The total number of customers connected by the end of June 2005 was 570,665, mainly residential, industrial and commerce.\(^2\) The average growth of the customer base since 2000 was between 6-9%. In terms of generation, the total available installed capacity is 890MW. The sources include TANESCO (590MW), SONGAS (200MW), and the Independent Power Tanzania Limited-IPTL (100MW). TANESCO also imports power from Uganda for Kagera region and from Zambia for Tunduma town, Sumbawanga and Mbozi districts. The total generation for the month of July 2005 reached 307,187,363 kWh (SONGAS contributing about 31%, IPTL 18% and TANESCO contributing about 51%)\(^3\).

TANESCO has a number of substations scattered all over the country. Some substations are for the stepping-up from e.g. 11kV to 220kV using 11/33/66/132/220kV conversion transformers. These are mainly used at generating source to prepare the generated power ready for

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1. 2002 census
2. source TANESCO
3. Source TANESCO generation report for the month of July 2005 and Verbal communication with Director Thermal Generation, August 2005

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transmission purposes. There are also step-down substations which reduce the transmission voltage into distribution voltage, say from 220kV to 11kV. This is done through a substation having 220/132/33/11kV conversion transformers. In this audit study the substations are of step down transformation ranging from 220/132/33kV to 33/11kV.

In 2002, TANESCO in collaboration with Japanese International Cooperation Agency (JICA) prepared a Master Plan to improve the power systems in major towns of Dar es Salaam, Kilimanjaro and Arusha. The current power demands for these regions are on average 240MW, 30MW and 38MW respectively. The Master Plan outlines areas of priority and investments needed to solve the frequent power outages experienced in major cities. Further, TANESCO undertook several studies including Relief Project 2 done by NetGroup Solutions (Pty) Ltd of South Africa in 2004 and feasibility study on the Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution system done by Lahmeyer International of Germany in September 2004. All these studies identified areas of priority and type of investment needed by TANESCO to improve the transmission and distribution systems.

Based on the above-mentioned studies, TANESCO consulted various financiers to seek assistance in implementing different components of the Master Plan. The World Bank (WB) as one of the contacted financiers showed interest in supporting TANESCO in that respect. Hence TANESCO and the International Development Association (IDA)/World Bank are currently preparing a distribution rehabilitation and transmission reinforcement component as part of the Songo Songo Gas Development and Power Generation Project (Credit 3569-TA). The amount under discussion with the WB is about US$ 57 million.

1.1 The Project
The proposed project to be owned by TANESCO and co-financed by the World Bank and the Nordic Development Fund (NDF) at an estimated cost of 70m USD consists of two components: The first component involves the rehabilitation of 18 existing substations at Oyster Bay, Mikocheni, Msasani, Factory Zone I, Factory Zone II, City Centre, Factory Zone III, Sokoine, Kurasini and Ilala in Dar es Salaam. Others are Mount Meru, Unga Ltd., Kilte Ltd, Themiri and Njiro in Arusha and Boma-Mbuzi, Trade School and Kiyungu in Kilimanjaro region. These 18 substations out of all substations in Dar es Salaam, Arusha and Kilimanjaro have been selected for the rehabilitation because they are located in the areas with fast growing power demand and the systems have reached the capacity limit hence they are overloaded. Further there will be a repair and upgrade of the 11/33 kV distribution systems. The expected life cycle of the substation is about 30 years though it may continue to provide service after that period is over. This rehabilitation of Distribution Facilities involves:

- Supply and installation of 22 additional 15MVA, 33/11kV transformers to relieve the overload in the existing substations (i.e. replacing low capacity transformers e.g. 5MVA with medium capacity of 15MVA transformers)
- Supply and installation of about 33, 33/11kV circuit breakers and 124 11kV circuit breakers with associated switchboards
- Supply and installation of 50MVA 132/33kV transformer with a circuit breaker at Kiyungu, Njiro, and Kurasini Substations

*Source TANESCO, data up to May 2005*
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- Supply of materials and equipment for repair/upgrading of the distribution systems which make a provision for the following: reconductoring, protection systems, auto-reclosers and auto load break switches, SCADA, section analysers, boosters, lightening protection, distribution transformers, new 33/11kV lines and statistical metering.

Upgrading of substations means replacement of power transformers by a higher rated power transformer and its associated breakers. This will involve mainly upgrading of the foundations to a higher bearing capacity, which may mean also power outages of several days or weeks in some places if temporary measures of using mobile substations are not opted.

The second component involves the construction of new 132kV transmission lines and new 132/33kV substations as follows:

- 132kV T/L Ubungo 220/132kV S/S to Oyster Bay 33/11kV S/S (to be upgraded to 132/33kV S/S). The line will pass through Samu-Nujoma Road on the left hand side up to Mwenge then follows new Bagamoyo Road on the right hand side up to Oyster Bay S/S.
- 132kV T/L from Ubungo S/S to Factory Zone III (via Mandela road to Kurasini S/S, Mbagala S/S and Factory Zone II Gongo la Mboto).
- 132kV line from Factory Zone II -Gongo la Mboto 33/11kV S/S to proposed new 132/33kV Kinyerezi S/S to be located at Kinyerezi TANESCO plot.
- 132kV T/L from Moshi (Kiyungi S/S) to Arusha (Njiro S/S) and respective upgrade of both substations and with new 132/33kV substation near Kilimanjaro International Airport (KIA).

1.1.1 Project Objectives

The project will achieve the following objectives:

- Reducing the duration and frequency of power interruptions.
- Improving voltage conditions at consumers' premises.
- Reducing the power system losses.
- Improvement in marketing by facilitating the possibilities of connecting more customers.
- Improvement of TANESCO image to the public (less complains from customers).
- Attraction of more revenue for the company.
- The project will contribute to the effort by the Tanzanian Government of improving the livelihood of ordinary Tanzanians through the National Strategy for the Growth and Reduction of Poverty in Tanzania (MKUKUTA).

Component 1 of this project requires a comprehensive Environmental Audit Assessment (EAA) and component 2 requires a comprehensive Environmental Impact Assessment (EIA and SIA) and Resettlement Action Plan (RAP). Therefore, this report presents the Environmental Audit Assessment findings for component 1 above (i.e. 18 substations in Dar es Salaam, Arusha and Kilimanjaro and one additional substation at Chalinze in Coast Region).

World Bank requires that all investments comply with the World Bank Safeguard Policies and Environmental Guidelines as presented in the Pollution Prevention and Abatement Handbook (1998) and IFC Environmental Guidelines. It is also a Tanzanian requirement that all projects should undertake the Environmental Assessment before the implementation. The Tanzanian
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Environmental Management Act (2004) section 81(1-4) stipulates that it is the obligation of the project proponent to undertake environmental impact assessment study of the project.

Hence, for this study the following major guidelines and policies will be applied: Electric Power Transmission and Distribution guidelines (IFC), Occupational Health & Safety (IFC), and Natural Habitat (OP 4.04) because of potential oil pollution. Additionally, national requirement as reflected in various Tanzania’s sectoral policies, the National Environment Management Council (NEMC) Environmental Impact Assessment Guidelines (2002 update) and the Environmental Management Act (2004).

1.2 The Purpose of the Environmental Audit Assessment

The purposes of the Environmental Audit Assessment are:
- To identify present inadequacies in environmental management, and occupational health and safety issues in the facilities to be rehabilitated. Of particular interest are the present pollution if any and its potential clean-up costs.
- To determine the need for remedial actions necessary to bring the subject facilities into compliance with World Bank Safeguard Policies and
- To recommend actions to be taken to improve and strengthen TANESCO’s environmental, health and safety management.

1.3 Scope of Work

The Environmental Audit Assessment focused only on the 18 existing substations earmarked for rehabilitation in Dar es Salaam, Arusha and Kilimanjaro as outlined above plus one additional substation at Chalinze in Coast Region. The Audit took place in November and December 2004.

1.4 Methodology and Approach

To accomplish the audit assessment the following approach was applied:

1.4.1 Reviewing records and relevant documents

Reviewing all available relevant in house documents including the following: the Master Plan Study on the Power Sector for major towns in the United Republic of Tanzania; prepared by Electric Power Development Co. Ltd., Japan, September 2002, Feasibility Study Report on Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System, Prepared by Lahmeyer International October 2004 and various sectoral policies. We also reviewed the World Bank, (IFC) Pollution Prevention and Abatement Handbook, environmental and occupational health and safety guidelines and standards. Others include EMA (2004), 2002 environmental guidelines by NEMC and water standards. Basing on the selected criteria to be audited a checklist was then prepared to assess the condition of the substations and facilities.

1.4.2 Site Observations and Interview

All 18 substations in Dar es Salaam, Kilimanjaro and Arusha were visited for assessment and an additional one at Chalinze. Interviews and brief meetings with relevant staff and residents were conducted at Ilala, FZ III, Kiyungi, Unga Limited and Njiro Substations. However, majority of these substations are remotely controlled from main substations like Ilala, Ubungo, Njiro,
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Kiyungi and Factory Zone III. During the visit we conducted visual inspections and cross checked the critical issues using the prepared checklist. The checklist identifies issue as per the following criteria as deduced from the guidelines mentioned above.

- General environmental management;
- Waste management practices;
- Hazardous materials management;
- Groundwater and soil contamination control;
- Occupational health and safety management; and
- Noise management (Noise level measurements were taken in some substations to get an overview of the noise levels in the substations)

1.4.3 Use of secondary data
Apart from reviewing the available records, this assessment used data and laboratory test results conducted in the same substations for identifying polychlorinated biphenyls (PCB) in transformers and switchgears however, for different purposes. These assessments are: Situation Assessment and Environmental Audit, Power Sector Restructuring Project- Final Report Version 2.0 prepared by Stone & Webster Consultants, May 2004 and Inventory of Electrical Equipment Suspected to Contain Polychlorinated Biphenyls (PCBs) prepared by the Vice Presidents Office June 2004.

1.4.4 PCB identification methods
There are several practical methods in use to determine if the equipment (e.g. transformer, switch gear or capacitor) contains PCBs. The first method is the elimination method. In this method we have assumed the cut off year to be 1980. Thus by checking manufacturers’ records (nameplate) all transformers manufactured before 1980 and those having no information are assumed to be PCB suspects while all transformers made after 1980 and have full information about the dielectric fluid used (not listed in PCBs common names) are assumed to be PCB free. After elimination, further tests follow to ascertain whether the assumption is true or not. The methods include density test, chlorine frame test, dessil test kits and laboratory testing (gas chromatography with electron capture then comparing results against standard chromatograms for known arachlors). In this assessment all methods mentioned above were applied except the chlorine frame test.

1.4.5 Findings Evaluation
Using field observations, site screening tests, laboratory analysis, checklist and professional judgment the audit findings were evaluated and prioritized as of high, medium or low concern. For instance, if transformer was found to contain less than 50ppm it was classified as PCB free. This is the threshold level in most countries required by the law. If the equipment has 50ppm or above but below 500ppm, the equipment is classified as contaminated thus need to be properly labeled and controlled though it can be retained in service until the end of useful life. Hence there is low to medium concern about this group. If equipment is found to have PCBs concentration above 500ppm this is classified as pure PCB and this is of very high concern. If the concern is rated high it means a call for immediate attention or action.
1.5 Report Format
This environmental audit report comprises of five chapters. Chapter one provides the introduction of the project and methodology for conducting the audit. Chapter two provides the environmental audit and legal framework and chapter three provides baseline information and the Audit findings. It also provides the recommended remedial action required to bring the facilities into compliance with minimum WB requirement as stipulated in the guidelines. Chapter four provides the environmental management plan and monitoring. Chapter five provides a conclusion and recommendations in a prioritised list of actions. The report has an executive summary, substation location maps and appendices.

The audit findings are the actual observed conditions of the facilities overall environmental performance with respect to the guidelines checklist. The findings describe the main environmental management practice weaknesses. When responses from the facility’s management are available, they have been provided.
Chapter 2

Policy, Legal and Institutional Framework

Environmental management has become a global challenge and Impact Assessment is a requisite for every major project at local and international level. Financiers, governments, environmental agencies and the public are demanding environmental responsibility of every action taken by corporate. This is due to the fact that any development activity has the potential to impact negatively or positively to the environment and the society is the one, which benefit or loose. Therefore any development must be sustainable so as to provide goods and services for many years without compromising the ability of future generations to survive.

One of the useful tools in ensuring that the environment is given a due consideration is the Environmental Audit and Assessment (EAA). EAA provides an opportunity to assess past and present actions against standard believed to be the best practice in order to know deficiencies in the practices thus initiate corrective actions to remedy or improve the environmental performance.

This chapter reviews policies, legal, and guidelines, which guide actions to what is believed to be environmental management best practices. In order for the project to be acceptable it has to fulfil the Tanzanian policies and laws and at the same time must comply with the World Bank requirements. Hence, this chapter has categorized these requirements as Tanzanian, International Agreements (of which Tanzania is a signatory) and the World Bank.

2.1 Tanzanian requirements

2.1.1 The Environmental Management Act, 2004

This Act provides for legal and institutional framework for sustainable management of environment; outlines principles for management, impact and risk assessments, prevention and control of pollution, waste management, environmental quality standards, public participation and enforcement; it provides basis for implementation of economic and financial incentives designed to influence behaviour to ensure sustainable use of natural resources and protection of environment; it provides for implementation of the National Environmental Policy and it repeals the National Environmental Management Act, 1983 and provides for continued existence of the National Environment Management Council (NEMC).

The proposed project needs to recognize the Act in the sense that environmental management is a duty and that it is the right of every person living in Tanzania to live in clean, safe and healthy environment. Under the Act, environmental liability has been imposed to managers of bodies corporate. If the corporate commits an environmental offence, the manager is liable for prosecution and faces fine or imprisonment.
2.1.1 Environmental audit review
The prepared environmental audit report shall be submitted to the Council (NEMC) for review by the Multi-Sectoral Technical Review Committee (TRC) for the purpose of establishing the accuracy and coverage of key issues and providing appropriate recommendations for remedial measures.

2.1.2 Water Utilization Act (1974); amended in 1981
The Act establishes a central Water Board with the authority to regulate the use of water, to control water pollution, and formulating standards for effluents and stream quality. The Water Board grants the discharge consents. The 1981 amendments include Standards for Receiving Waters, based on their classification (i.e. Category 1, 2 or 3). The Act provides standards for Temperature, pH, organic substances and inorganic substances, oil and grease, etc. The standard allows the maximum limit of 10 ppm of any discharges of oil and grease to receiving waters. Any discharge of oil and grease in excess of 10 ppm must be treated before being discharged. Therefore, any discharges from the planned or operating facility must abide by these limits.

2.1.3 The Land Act, 1999 (No 4)
One of the fundamental principles of this Act is to ensure that land is used productively and that any such use complies with the principles of sustainable development. The Act also stipulates procedures of acquiring land from the rightful owners and the required compensations. However, this component of the project is expected to utilize the existing land already occupied by TANESCO. Nevertheless, if need to acquire more land for the upgrading of substations arises, then all procedures of acquiring land as stipulated in this Act must be followed.

Further, the proponent should know that after the useful life of the Substation is over the land should be left in a state where others can use it. Hence, the project should do the decommissioning of the project when the project activities come to an end.

2.1.4 The Village Land Act 1999 (No 5)
In case the concerned land is in rural areas, the law to be used shall be the village Land Act of 1999 known as land Act number 5. This Act provide for the management and administration of land in village and related matters.

2.1.5 The Occupation, Health and Safety Act 2003
The Act repeals the Factories Ordinance 1950. It makes provisions for the safety, health and welfare of persons at work in factories and other places of work. It also provides protection of people other than persons at work against hazards to health and safety arising out of or in connection with the activity. Therefore, health and safety is must for the employer, employees and people around the facilities.
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2.1.6 The Energy and Water Utilities Authority Act 2001 (Act No. 11)
The Act establishes a Regulatory Authority in relation to energy and water utilities and to provide for its operation in place of former authorities and for related matters. Recognition of this Regulatory Authority is important for this project.

2.1.7 The Industrial and Consumer Chemicals (Management and Control) Act, 2003
This Act provides for the management and control of the production, importation, transportation, storage, dealing and disposal of chemicals. The activities and the work sites of the proposed project may produce or store forbidden chemicals particularly PCBs normally found in old transformers and switch gears. Hence appropriate management of these substances will be required.

2.1.8 Electricity Ordinance 1957 [Cap. 131- Supp. 57]
This is a ordinance that facilitates and regulates the generation, transmission, transformation, distribution, supply and use of electric energy for lighting and other purposes. Since this project is about the electricity distribution, then this ordinance will be applicable in some issues.

2.1.9 Petroleum (conservation) Act, 1981 (Act No. 18 – 1981)
This Act provides for regulation of the impact, transport, storage, distribution, sale and use of petroleum products and connected matter. Substations have oil in transformers and switch gears which require proper management and handling.

2.1.10 National Environmental Policy (NEP 1997)
The National Environmental Policy provides the framework for making fundamental changes that are needed to bring environmental considerations into the mainstream of decision-making. It also seeks to provide policy guidelines, plans and guidance to the determination of priority actions, and provides for monitoring and regular review of policies, plans and programmes.

The policy among other environmental issues, it insists on prevention and control of land, water, vegetation and air degradation, which constitute our life support systems. It also requires protection of biological diversity of unique ecosystem.

2.1.11 Sectoral Policies
The following sectoral policies recognize the importance of environmental protection and highlight needs and the obligation of any project proponent (developer) to safeguard it so as it continues to support our life systems. The policies include:

The energy policy of February 2003 insists on the need to consider environment in its totality. Issues such as energy production (construction of electricity facilities, their operation and
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maintenance), procurement, distribution systems, and utilization should be done in an environmentally sound manner.

2.1.11.2 National Water Policy (2002)
The policy insists on the integrated water resources management involving all stakeholders. It further emphasises that water resources shall be conserved and water pollution should be avoided. The relevancy of this policy to this audit study is to remind the project proponent the need to avoid any kind of oil spills, wastes of harmful substances or any other substances that may cause water pollution of the source or water body of any kind during project implementation, operation and decommission.

2.1.11.3 The National Land Policy (1996)
The policy developed with the main aim of ensuring wise use of land, it guides land allocation, resolve conflicts and prevent degradation. The policy gives guiding principles and mandate to local authority on issues related to environmental management. The relevancy of this policy to the project is about land tenure and right of occupancy. Further the policy gives guidance on protecting sensitive areas by not allocating such areas for social or economic development.

2.1.11.4 National Human Settlement Development Policy (2000)
The policy is under Ministry of Land and Human Settlements Development and it emphasizes on the integration of all human activity processes – residence, work, education, health, culture leisure and the physical structures that support the human settlement. Hence with good intention of the government in facilitating adequate delivery of shelter and improving development of sustainable human settlement in the country, the supply of reliable electricity in these settlements is vital in ensuring the quality of life.

2.1.11.5 Sustainable Industrial Development Policy - SIDP (1996 - 2020)
SIDP policy, which was developed by the Ministry of Industry and Trade, intends to promote an environmentally friendly and ecologically sustainable industrial sector in Tanzania. The policy insisted in the following, which are relevant for this project:

* Environmental Impact Assessment (EIA) and appropriate mitigation measures are enforced.
* Promotion of Investment, which contain anti pollution programs.
* The government will promote the continuous application of integrated environmental strategy to industrial process, products and services. This strategy will include propagating efficient use of raw materials and energy; elimination of toxic or dangerous materials, as well as reduction of emissions and wastes at resources.
* The government will forge deliberate and mandatory devices to reactivate legal mechanisms to enable involved institutions to be more effective in matters of environmental management.

2.1.11.6 Wildlife Policy of Tanzania (1998);
The Wildlife Policy of Tanzania (1998) developed by the Ministry of Natural Resources and Tourism, provides a background on the country’s wildlife resources and potential, and roles various institutions and stakeholders involved in wildlife management. Relevant to this audit
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study is the obligation to protect the biodiversity. Of particular interest is conserving the endangered and threatened species of flora and fauna and their habitats.

2.1.11.7 Other Relevant Policies

There are other relevant policies to this study, which are worth mentioning. These include Health Policy particularly on the issues of occupational health; and Construction Industry Policy (2003). All these policies emphasize the importance of project proponent to consider all aspects ranging from the welfare of the workers to other people who may be affected negatively or positively by the project. They are also insisting on the best practice on environmental management. Early consideration of all aspect will make the investment to be sustainable.

2.2 International agreements on environment

Tanzania has also committed herself to a number of international agreements on environment and development. The relevant international agreements to this environmental audit include:

- Convention on Biological Diversity (CBD), adopted in May 1992. The aim of this convention was on developing national strategies for the conservation and sustainable use of biological diversity
- The Climate Change Convention adopted in June 1992 and ratified in March 1996. The major aim of this convention is to combat the global warming by reducing emission of greenhouse gases
- Convention concerning Protection of Workers against Occupational Hazards in the Working Environment due to Air pollution, Noise and Vibration, adopted in 1977. The aim of this convention is to ensure the safe working environment for the workers
- Stockholm convention on Persistent Organic Pollutants (POPs). The convention calls for all countries to properly manage the pollutants such as Polychlorinated biphenyls (PCBs) and advises restrictions on the marketing, use and disposal of PCBs

2.3 The World Bank requirement

The World Bank, through the International Development Agency (IDA) and the IFC has established Safeguard Policies and environmental guidelines of which a lender needs to comply depending on the nature of the project. For this Environmental Audit Assessment the following policies and guidelines may apply.

2.3.1 WB Safeguard Policies

OP 4.01: Environmental Assessment: Requires an Environmental Impact Assessment for all projects to be funded by the World Bank Group to ensure that they are environmentally sound and sustainable.

Applicability of the policy to this project

Component one of the project has to do with rehabilitation of the existing facilities which in most cases will be confined in the existing sites. These existing sites require the audit assessment
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while for the new substations or construction of new transmission lines (component 2 of this project) require the Environmental Impact Assessment.

OP 4.04: Natural Habitat: Aims to promote and support natural habitat conservation, protection, maintenance, and improved land use. It insist on precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development

Applicability of the policy to this project
This policy is applicable in the sense that it is required to control oil pollution on land (soil) and water and any behaviour that will affect natural habitat or degrade the land which can be used for other purposes

OP4.12: Involuntary Resettlement: Aims to minimize the involuntary resettlement whenever possible. Resettlement Action Plan (RAP) is needed to reduce impacts to those who will be displaced by the project.

Applicability of the policy to this project
It is anticipated that rehabilitation of the substations will not need extra land. However, in case substation designs change and extra spaces are required, procedures for acquiring land will be followed including the preparation of Resettlement Action Plan that will be submitted to the local authority and the WB.

OPN 11.03: Cultural Property: requirement to protect and conserve cultural sites

Applicability of the policy to this project
For the sites to be rehabilitated, no cultural properties are expected to exist on the site as the rehabilitation work will be on the already disturbed land sites. However, it shall be considered in case of new Substations and new transmission lines.

2.3.2 Pollution prevention and Abatement Handbook Guidelines

The purpose of the guidelines among other things is to identify environmental, health and safety problems and recommend cost-effective measures that could improve the environmental, health and safety performance to meet the WB standards. The guidelines that have been considered in preparing the Environmental Audit Assessment checklist (Appendix 1) include the following:

1. Electric Power: Transmission and Distribution
2. Polychlorinated Biphenyls (PCBs)
3. Occupational Health and Safety Guidelines
4. Environmental Monitoring and
5. General Environmental guidelines

These guidelines in a nutshell:

- Require having in place acceptable working environment and it is the obligation of the employer to provide that acceptable working environment, provide all necessary personal protective gears (PP) to employees, first aid kit, and essential welfare facilities and enforce the use of PP when necessary

- Require that all discharges from the facility to be treated to acceptable limit levels before being release to water bodies
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- Require to have equipment, a system or procedures in place to control spillages that may contaminate soil, underground and surface water.

- Require to have a plan or a system in place to deal with emergence cases of fire, spillage or accidents in place of work or facility to minimize the number of casualties, damage costs and environmental disaster.

- Require to have a knowledgeable workforce to reduce health and safety risks of the workers and safety of equipment as well as improving the working efficiency.

- Require to have habit of keeping records as a proof of compliance, for easy of reference, and in reviewing the performance when need arises.

- Require a systematic phasing out PCBs and Chlorofluorocarbon compounds (CFCs) containing equipment and in ensuring appropriate storage and disposal.
Chapter 3

Site Baseline Information, Audit Findings and the Remedial Actions

The substations included in this Environmental audit Assessment project are located as follows:

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<tr>
<th>Kinondoni North</th>
<th>Kinondoni South</th>
<th>Ilala Region</th>
<th>Temeke Region</th>
<th>Arusha Region</th>
<th>Kilimanjaro Region</th>
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<tr>
<td>Mikocheni</td>
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<td>Ilala</td>
<td>FZ I</td>
<td>Njiro</td>
<td>Kilimanjaro</td>
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<td>City Centre</td>
<td>Kurasini</td>
<td>Themi</td>
<td>Boma Mbuzi</td>
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<td>Oyster Bay</td>
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<td>FZ II</td>
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Although Lawati Substation was in the WB terms of Reference, it was left out in this study after discussion with Kilimanjaro Senior Engineer that the concerns are on Trade School substation and not Lawati Substation. Hence Trade school substation replaces the Lawati substation.

*It was also recommended that Chalinze Substation be included in the project though it is outside the above mentioned regions.

This Environmental Audit was conducted between 9th November 2004 and 10th December 2004. The audit was based on criteria stipulated below:

- General environmental management;
- Waste management practices;
- Hazardous materials management;
- Groundwater and soil contamination control;
- Occupational health and safety management; and
- Noise management (Noise level measurements were taken in some substations to get an overview of the noise levels in the substations)

These criteria were translated into a checklist which was used to identify issues of strength to the subject substation or issues that need corrective actions (weakness) so as to meet the minimum required standard.

The approach to this audit included the site inspection, equipment and material identification (PCB content transformers and switch gears), interview of personnel and residents working in the substations or living near the substation. Available records or documentation were also verified.

Substations which have been audited using the criteria above include the following:

5 TANESCO has four operational regions in Dar es Salaam which are Kinondoni North, Kinondoni South, Ilala and Temeke all located in Dar es Salaam administrative region
iv. Fire fighting equipment is inadequate need to be adequately supplied in the required proportions (foam, carbon dioxide, powder, etc.) and recharged when expire

v. The substation site will require an extra land if expansion is needed

3.2 Oyster Bay 33/11kV Substation
This substation is located in a plot at the junction of Ali Hassan Mwinyi road and Kawawa road in Kinondoni district. On the north there is Ali Hassan Mwinyi road and on the west of the substation there is Kawawa road. The eastern side is bordered by residential houses and on the south an empty space. This substation is remotely controlled from Ilala and Ubungo substations. The area is dominated by the noise of passing vehicles. The potential environmental risks come from oil, SF6 and CFC gasses, and safety risk mainly from electric shock.

The substation (see photo 2.1-3 in Appendix 2) is currently equipped with one 33/11kV, 15MVA transformer (1993) with two stand-by transformers of capacity 5MVA each manufactured in 1963. The substation is overloaded and requires immediate attention. A 33kV line to Ilala and Mikocheni connects the substation.

The proposal recommends among other things the following rehabilitation: changing 33kV and 11 kV switchboards, circuit breakers, cubicles, installation of two new 33/11kV, 15MVA power transformers.

3.2.1 Audit findings and the required remedial actions: Oyster Bay Substation

From the site investigation and checklist the following issues were identified:

1. The substation has transformers and oil circuit breakers of 1963 and 1993. Hence by elimination method one transformer in the substation has got no PCBs. However for the two transformers of 1963 the laboratory tests showed some traces of Aroclor 254 and Aroclor 1260 with concentration 405 ppm and 352ppm respectively. This result concludes that these two transformers are PCB contaminated. Therefore, appropriate handling is required including prevention of leakages and restriction on moving them

2. The transformers are oil leaking however they are labelled and restricted from shifting to another place without the permission of the Vice presidents Office.

3. It has few window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used for repair work in Tanzania. However, no disposable units were seen at the site.

4. The substation has no oil containment for the installed transformers. Which means any leakage will not be recovered and it will go underground.

5. The substation is remotely controlled from Ilala hence only a security guard is on the site. The outside noise level is averaged at 56dB during the day, which might also be influenced by the passing vehicles on Ali Hassan and Kawawa Roads.

6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects
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7. The substation is fenced and has warning signs to prevent the general public from electrocutions. However the fencing needs some repairs.

8. The substation needs improvement in the following areas:
   i. Repair of security lights, fence, broken slabs and putting danger signs on the fence
   ii. Cleanliness of the substation (taking out grasses) and supply more gravels
   iii. Emergency preparedness, prevention and response plan for the substation needs to be prepared and rehearsed
   iv. Fire fighting equipment are inadequate need to be adequately supplied in required proportions (foam, carbon dioxide, powder)
   v. Handling of hazardous and non hazardous material need to be improved especially in storage arrangement and prevention of spillage
   vi. Waste handling and disposal

3.3 Msasani 33/11kV Substation
This substation (see photo3:1-3 in Appendix 2) is located at Msasani area in the TANESCO compound used by Dar es Salaam Rehabilitation Project. Residential houses are located some 100 - 200m from the substation.

The substation is currently equipped with one 33/11kV, 15MVA transformer (1993). The substation supplies load within the Oyster Bay and Mikocheni area. No 33kV busbar system is installed. The substation is of the t-off type connected to Oyster Bay. On the 11kV side a container type substation was built in 1993 under the Japanese project. No expansion of the 11kV board is possible.

The proposal is to relief the load from this substation when the new Oyster Bay substation is constructed. Expansion of this substation is not recommended.

3.3.1 Audit findings and the required remedial actions: Msasani Substation
The audit found the following at Msasani substation:
1. The substation has transformers and oil circuit breakers of 1993 hence by the elimination method the substation has no transformer with PCBs
2. Small oil leakage was seen on the one of the Oil Circuit Breaker but has been controlled
3. The substation has no any equipment which may contain chlorofluorocarbons (CFCs)
4. The substation has no transformer oil containment. However no oil leaks were seen on the transformer
5. The S/S is remotely controlled no operators on the site. The site noise level is averaged at 47dB during the day
6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects
7. The substation is well fenced and has warning signs to prevent the general public from electrocutions.

8. The substation needs improvement in the following areas:
   - Cleanness (taking out grasses) of the substation particularly outside and the supply of more gravels is recommended.
   - Emergency preparedness, prevention and response plan for the substation needs to be prepared and rehearsed.
   - Fire fighting equipment are inadequate need to be adequately supplied in required proportions (foam, carbon dioxide, powder) and regular servicing.
   - Handling of hazardous and non-hazardous material need to be improved especially in storage arrangement and prevention of spillage.

3.4 Ilala 132/33/11kV Substation

This substation (see photo 4:1-3 in Appendix 2) is located at Mchikichini area behind the Tanzania Breweries Limited factory. Outside the substation there are some residential houses in west and east. On the northern side there is Mchikichini primary school. The substation is enclosed by a brick wall separating the substation and other activities.

The substation is currently equipped with three 132/33kV, 45MVA transformers and three of 33/11kV, 15MVA transformers all manufactured in 1987. The 33/11kV transformers are fully overloaded.

The proposal was to extend two bays with all equipment and accessories to allow the 132kV second circuit from Ubungo and also to allow extension of 132kV line from Ilala to Kurasini.

3.4.1 Audit findings and the required remedial actions:

The audit identified the following issues and provides the remedial action on article 8.

1. The substation has transformers and oil circuit breakers of 1987. Hence by the elimination method (transformers manufactured after 1980 are assumed to be PCB free while those made before 1980 are assumed to be PCB suspect), the substation has no transformer or switch gear with PCBs.

2. No oil leakage was observed.

3. It has few window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used in Tanzania. However, no disposable units were seen at the site.

4. The substation has no oil containment for the installed transformers. No oil leaks were seen on the site.
5. Air condition units maintain workplace air quality and inside the building there is no noise. The outside noise level is averaged 55dB during the day, which also might be influenced by the nearby brewery industry.

6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects.

7. The substation is well fenced and has warning signs to prevent the general public from electrocutions.

8. The substation needs improvement in the following areas:
   i. Regular training of all personnel in safety & safety procedures, work procedures, accident and accident prevention and health risks.
   ii. Availing more reference materials of which employees could refer to or improve their knowledge.
   iii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed.
   iv. First aid kit need to be furnished with important drugs and necessary equipment.
   v. Fire fighting equipment is inadequate and need to be adequately supplied in required proportions (foam, carbon dioxide, powder) to be located appropriately. Also, these equipment needs to be checked and serviced regularly.
   vi. Handling of hazardous and non-hazardous material need to be improved especially in storage arrangement and prevention of spillage.
   vii. Waste handling and disposal (required to have a designated areas for waste collection and rightful way of disposing them).

3.5 City Centre 33/11kV Substation

This substation (see photo 5 in Appendix 2) is located at Kisutu area near the National Library and other office buildings. It is enclosed by brick wall on all sides. The substation is remotely controlled from Ilala and from Ubungo substations.

The substation is currently equipped with one 33/11kV, 15MVA transformer (1979) with one stand-by transformer of capacity 15MVA manufactured in 1979. The substation was partly damaged by fire in 2001 and refurbishment of the existing indoor switchgear and protection system is on going.

It is proposed to rebuild the substation as an indoor 33/11kV substation with two new 33/11kV, 15MVA power transformers. The proposal also recommends among other things changing 33kV and 11 kV indoor switchboards, circuit breakers, various cubicles (transformer, bus coupler, feeder, etc.) and a building to house the above items and protection panel.

3.5.1 Audit findings and the required remedial actions: City Centre Substation

The audit found the following:
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1. The substation has transformers and oil circuit breakers of 1979, which make substation a PCBs suspect. However, the laboratory results performed in April 2004 did not detect any trace of PCB compounds. Hence the substation is PCB free.

2. Oil leakage seemed to be there and the major cause was the mishandling during the maintenance.

3. The substation is remotely controlled from Ilala substation. Hence no equipment was seen that may have contained chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used in Tanzania.

4. The substation has no oil containment thus oil leaks may contaminate underground water.

5. The substation is earthed and has protective shields to minimize radiation and magnetic field effects.

6. The substation is fenced though it needs some repairs.

7. The substation needs improvement in the following areas:
   i. Repair of security lights
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iii. Eliminate features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches
   iv. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) and ensure that they are serviced regularly
   v. Handling of hazardous and non hazardous material need to be improved especially in storage arrangement and prevention of oil spillage
   vi. The substation needs the yard cleanliness and appropriate waste handling and disposal practices
   vii. The toilet used by the security guards and people working on the site need Repairs

3.6 Sokoine 33/11kV Substation
This substation (see photo 6 in Appendix 2) is located near the National Insurance Company investment house and the headquarters of Bank of Tanzania (BOT) along the Sokoine Drive. The substation is enclosed by the brick wall. It is remotely controlled from Ilala.

The substation is currently equipped with one 33/11kV, 15MVA transformer (1993). This substation is currently heavily loaded. The substation is made up of an outdoor 33kV part with one incoming line bay and one transformer bay. The incoming feeder is connected by a single core underground cable, XLPE 300mm² copper of 300m to the dead end structure of the line to Ilala (ACSR 150mm²). The containerized 11kV substation built in 1993 cannot be extended by additional feeders.

It is suggested that due to the entrance limitation, which makes it difficult to expand, no action to this substation be undertaken unless the underground cable ring is realized. Hence some load in the area should be supplied through the additional capacity proposed at City Centre and new Railway substations.
3.6.1 Audit findings and the required remedial actions: Sokoine Substation

The audit found the following:
1. The substation has a transformer and oil circuit breakers of 1993 hence by the elimination method the substation is PCB free
2. No oil leakage was seen on the transformer or on the breakers
3. The substation is an outdoor type and remote controlled substation, hence no equipment is suspected to contain chlorofluorocarbons (CFCs) used in air-conditioning units
4. The substation has transformer oil containment thus no leakage will be allowed to go to the underground water
5. The substation is earthed and shield protected to minimize radiation and magnetic field effects
6. The substation is fenced and has warning signs to restrict access thus prevent the general public from electrocutions or electric shock.
7. The substation needs improvement in the following areas:
   i. Repair of security lights
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iii. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder)
   iv. The substation needs appropriate waste handling and disposal practices
   v. The substation toilet needs repairs to offer a convenient place for the security guards and people working on the site to go

3.7 Factory Zone II 33/11kV Substation

This substation (seen on photo 7 Appendix 2) is located at Gongolamboto industrial area. The substation is between Namera textile mills and the proposed Dar es Salaam City slaughter house (abattoir).

The substation is currently equipped with one 33/11kV, 5MVA transformer of 1967. The indoor 11kV switchboard is overloaded and the protection system is in poor condition.

It is proposed that the substation be rebuilt to the existing site as an indoor 33/11kV substation with two 33/11kV 15MVA power transformers. The proposal also recommends among other things changing 33kV and 11kV indoor switchboards, circuit breakers, various cubicles (transformer, bus coupler, feeder, etc.) and a building to house the above items and protection panels.

Following the changes of 132kV transmission routes in Dar es Salaam, this substation will be upgraded to 132/33kV to allow connection with the line from Mbagala, Factory Zone III and Kinyerezi substations. In that case extra piece of land will be required.
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3.7.1 Audit findings and the required remedial actions: Factory Zone II Substation

The audit found the following:

1. The substation has a transformer of 1967, which makes the substation a PCB suspect. However, the study by the Vice President's Office in August 2004 concluded the substation has PCBs compounds below 50ppm based on the density detection method as the weight of the oil and density of the oil were provided by transformer manufacturer. No laboratory analysis was performed. Hence the substation is concluded by the study as PCB free.

2. The transformer has traces of oil leaks presumably due to overloading and oil mishandling during maintenance activities.

3. It has no equipment suspected to contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used as air conditioning refrigerant in Tanzania.

4. The substation transformer has no oil leakage containment, which means leaks will soak into the soil and then to surface and underground water.

5. Although it is remotely controlled, there are security guards at site who require convenient shade for rain and sun and toilet facility. The substation is located in industrial area where a substation noise will not exceed 70dB as shown in measured substation.

6. The substation is earthed to minimize radiation and magnetic field effects.

7. The substation fencing is in very bad condition. It needs repair and posting of the danger warning signs to restrict access to the substation thus prevent the general public from electrocutions.

8. The substation needs improvement in the following areas:
   i. Repair of security lights and fencing
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iii. Eliminate features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches
   iv. Drainage system of the substation. It was reported by the security guard that the substation is normally flooded whenever there is heavy down pour
   v. Adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) must be supplied and checked regularly
   vi. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of oil spillage
   vii. The substation needs cleanliness, extra gravels on the site and appropriate waste handling and disposal practices
   viii. There is need to construct a security guard kiosk (shade) and toilet facility for convenience of the guards on the site

3.8 Factory Zone III 132/33/11kV Substation

This substation (seen on photo 8 Appendix 2) is located at Kipawa along Nyerere road close to the Dar es Salaam International Airport. It is in the vicinity of Nyerere road industrial zone. It
receives 132kV from Ubungo main grid centre. The substation has one building which houses offices, battery room and control room.

The substation has 132kV, 33kV, and 11kV voltage levels transformation. The 132kV line bay from Ubungo has two 132/33, 45MVA transformer (1999) bays. The 33kV part is the outdoor type with one 33/11kV, 15MVA transformer with several line bays. On the 11kV side a container type substation was built in 1987 under the Japanese project. No expansion of the 11kV board is possible.

It is recommended to extend 132kV line bay to accommodate the new 132kV line from Ilala S/S to FZ III via Kurasini, Mbagala and Yombo. The bay will contain all necessary equipment (circuit breakers, current transformers, capacitive voltage transformers, arrestors, etc.). Also it is recommended to add a full 33kV transformer bay, 33/11kV 15MVA transformer. Other rehabilitation will include major service of the existing transformer and switchgears, oil type 33kV circuit breaker shall be replaced and adding two 33kV outgoing feeder bays.

3.8.1 Audit findings and the required remedial actions: Factory Zone III Substation
The audit found the following:
1. The substation has transformers and oil circuit breakers of 1987 and 1999 hence by the elimination method the substation has no transformer or circuit breaker with PCB. Hence the substation is PCB free
2. Oil leakage was seen on CUB - 3 oil circuit breaker
3. It has few window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 which is the common and cheap air conditioning refill refrigerant in Tanzania. However, no disposable units were seen at the site
4. The substation has no transformer oil containment dikes hence in case of spillage accident soil, surface and underground water will be contaminated. New installation must be contained to prevent oil spills. However, no oil leaks were seen on the transformers
5. Air conditioning units maintain workplace air quality and the noise inside the building is below the limit. The outside noise level is averaged 50dB during the day, the level which has been influenced by the nearby biscuits factory (20m away) and passing vehicles on the Nyerere road located 50m away
6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects
7. The substation is well fenced and has warning signs to restrict access by unauthorized people thus prevent the general public from electrocutions
8. The substation needs improvement in the following areas:
   i. Regular training of all personnel in safety & safety procedures, work procedures, accident and accident prevention and health risks
ii. Availing more reference materials of which employees could refer to or improve their knowledge

iii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed

iv. First aid kit need to be furnished with important drugs and necessary equipment

v. Fire fighting equipment are inadequate need to be adequately supplied in required proportions (foam, carbon dioxide, powder) and ensure a regular checks

vi. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of spillage

vii. Repair of security lights, indoor lights and window air condition units to improve working condition of the Substation

viii. The substation needs cleaness especially in removing grass in the yard and appropriate waste handling and disposal practices

3.9 Factory Zone I 33/11kV Substation

Factory Zone I substation is located at Buguruni along the Mandera Express way close to the traffic lights at junction of Nyerere road and Mandela express way. This substation is located in an industrial area. It has two buildings housing the control unit. The substation is remotely controlled.

The substation is currently equipped with one 33/11kV, 15MVA transformer of 1993. Though it is now disconnected after developing an internal fault. The one in operation now with the same capacity was manufactured in 1969. It is proposed that the substation be rebuilt to the existing site as an indoor 33/11kV substation with two 33/11kV 15MVA power transformers.

The proposal also recommends the substation to be equipped with 33kV and 11 kV indoor switchboards, circuit breakers, various cubicles (transformer, bus coupler, feeder, etc.) and a building to house the above items and protection panels.

3.9.1 Audit findings and the required remedial actions: Factory Zone I Substation

The audit found the following:
1. The 1969 transformer makes the substation, as a PCB suspect while the one of 1993 is non-PCB. However the results of laboratory analysis conducted in April 2004 have shown that the transformer of 1969 has some traces of Aroclor 1260 and Aroclor 1254 PCB compounds of less than 1ppm. Therefore, the result concludes that the substation is PCB free in spite of having a 1969 transformer.

2. Small oil leakage was seen on one of the transformer
3. The substation building has two window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is common and cheap AC refrigerant in Tanzania. However, no disposable units were seen at the site

4. The substation has no transformer oil containment which means any leakage goes to the soil and eventually to surface and underground water

5. The substation is remotely controlled hence only a security guard is on the site. The working conditions need to be improved for the guards by providing security guard kiosk and toilet facility. The noise level is normal though influenced by the moving vehicles on Mandela road and foundry workshop adjacent to the substation.

6. The substation is earthed shield protected to minimize radiation and magnetic field effects

7. The substation is fenced and has warning signs to restrict access to the substation thus prevent the general public from electrocutions

8. The substation needs improvement in the following areas:
   i. Repair of security lights and window AC
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iii. Elimination of features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches
   iv. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder)
   v. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of oil spillage
   vi. The substation needs cleanliness and appropriate waste handling and disposal practices
   vii. Construction of the toilet and security guard kiosk to be used by the security guards and people working on the site during Repairs and maintenance work

3.10 Kurasini 33/11kV Substation
Kurasini substation (seen in photo 10:1-3 in Appendix 2) is located off Mandela express way at Kurasini adjacent to the Scandinavian express warehouse. It is remotely controlled from Ilala and Ubungo substations. It has one small house with indoor controls. This substation is basically located in an area designed for warehouses, therefore only few residential houses belonging to TAZARA staff are behind the substation. As this substation is among those which will be upgraded to 132/33kV, extra land will be required. This means about 3 houses belonging to TAZARA staff need to be relocated. Land acquisition procedure shall be followed so as acquire the extra piece of land. The Social Impact Assessment and Resettlement Policy Framework (RPF) documents for Dar es Salaam address those issues.

Kurasini substation is currently a 33/11kV substation. It is at present equipped with one 33/11kV, 15MVA transformer of 1979 with two oil circuit breakers 36kV, 600A, 12.5kA dated
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1967 of South Wales made. Three 33kV CB were replaced in 2003. The indoor 11kV switchboard and the monitoring and control devices are installed in the building.

The proposal is to extend the substation by an outdoor 132kV switchyard consisting of one line bay for connecting the new Ubungo - Kurasini Line, one line bay for connecting the new line Kurasini – Mbagala – Gongolamboto – FZ III, one 132/33kV 50MVA transformer bay. Further it is proposed to build an indoor 33 and 11kV substation with one-33/11kV 15MVA power transformers. Other things include improving the 11kV cable connection, changing circuit breakers (with SF6 or Vacuum type), various components in protection and monitoring systems.

3.10.1 Audit findings and the required remedial actions: Factory Zone II Substation

The audit found the following:

1. The substation has transformers and oil circuit breakers of 1979 and 1967 respectively. By elimination method the substation is classified as PCB suspect. However, since TANESCO has a tendency of doing refilling of new oil to all transformers in substations from time to time and that no pure PCB has been found in TANESCO transformers it may be assumed that the substation is also free from PCB in most cases (i.e. below 50ppm) even though no laboratory tests has been conducted on this substation.

2. No oil leakage was observed

3. It has no equipment that may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly found in AC and refrigerators in Tanzania

4. The substation has no transformer oil containment which means any leakage goes to the soil and eventually to surface and underground water

5. The substation is remotely controlled and the average ambient noise on the switchyard is 48dB during the day. Few residential houses are located about 20-40m from the substation and the Mandela road is also located some 50m from the substation

6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects

7. The substation is fenced though needs some repair work to improve the inaccessibility by unauthorized people to prevent them from electrocutions

8. The substation needs improvement in the following areas:
   i. Repair of security lights
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iii. Elimination of features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches
   iv. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) and ensuring the regular checkups
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v. Handling of hazardous and non-hazardous material need to be improved especially in storage, arrangement and prevention of oil spillage
vi. The substation needs cleanliness and appropriate waste handling and disposal practices
vii. Need for constructing a security guard kiosk and a toilet to be used by the security guards and people working on the site during Repairs and maintenance work

3.11 Njiro 220/132/33kV Substation

This substation (seen on photo 11: 1-2 in Appendix 2) is located at Njiro hills in Arusha town. It receives energy from Singida through the 220kV transmission line and from Kiyungi and Pangani Hydro Systems through the 132kV transmission line. Residential houses are located as far as 150-300m from the substation.

The substation has 220kV, 132kV, and 33kV voltage levels bus bars and 220/132kV and 132/33kV transformers. The 220kV connects with the national grid from Singida and the 132kV connects to the hydropower stations of the Pangani Hydro Systems through Same and Kiyungi substations. The substation has two 132/33, 20MVA transformers manufactured in 1981 while those of 220/132 20MVA were manufactured in 1996. The transformers are overloaded especially at peak hours and the oil temperature reaches more than 90 °C. The transformers are of cooling type ONAN and the extension will convert to ONAF thus increasing the rated load to 30MVA each.

The proposal is to exchange the two 132/33kV, 20MVA transformers with two 132/33, 50MVA transformers or install additional 132/33kV, 50MVA transformer and related transformer bay equipment to support the existing two transformers. Also it is proposed to install 132kV bay to connect the new 132kV line from Kiyungi S/S via Kilimanjaro International Airport (KIA). For distribution system two additional 33kV line bays are being proposed to feed New Kiltex and new Njiro B substations.

3.11.1 Audit findings and the required remedial actions: Njiro Substation

The audit found the following:
1. The substation has transformers of 1981 and 1996 and switch gears use SF6 gas hence by the elimination method the substation is PCBs free
2. Small oil leakage was seen one of 132/33kV transformers
3. It has few window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used in Tanzania. However, no disposable units were seen at the site
4. The substation has oil containment for newly installed transformers (220/132) but lacks the containment for the old installations (132/33kV transformers)
5. Air condition units maintain workplace air quality and there is no noise inside building. No
noise measurement were taken at this substation, it is assumed that it is no different from other
substations. Residential houses are located about 100m – 150m from the substation fence and
no noise complains have been reported up to date
6. The substation is earthed and has protective shields to minimize radiation and magnetic field
effects
7. The substation is well fenced and has warning signs to prevent the general public from
electrocutions
8. The substation needs improvement in the following areas:
   i. Regular training of all personnel in safety & safety procedures, work procedures,
      accident and accident prevention and health risks
   ii. Availing more reference materials of which employees could refer to or improve their
       knowledge
   iii. Emergency preparedness, prevention and response plan needs to be prepared and
       rehearsed
   iv. First aid kit need to be furnished with important drugs and necessary equipment
   v. Fire fighting equipment are inadequate need to be adequately supplied in required
      proportions (foam, carbon dioxide, powder)
   vi. Handling of hazardous and non hazardous material need to be improved especially in
      storage arrangement and prevention of spillage
   vii. The substation needs appropriate waste handling and disposal practices
   viii. The substation needs to be supplied with one unit portable water (water dispensing
      unit)
   ix. The substation need to have in place a habit of investigating work related injuries, ill
      health, diseases and accident and keeping them in record

3.12 Themi 33/11kV Substation
Themi substation (seen on photo 12 Appendix 2) is located at Themi industrial area in Arusha
town. The controls are housed in the building and transformers are located outdoors. The
substation is supplying power to the fast growing residential and industrial areas.

The substation is currently equipped with one 33/11kV, 5MVA transformer of 1988. The 33kV
substation is of outdoor type with two line bays. The 11kV switchboard is of indoor type.

Under the project it is proposed to add a full 33kV transformer bay, 33/11kV, 15MVA power
transformers. It is suggested that the upgrade should include rebuilding the existing 1 x 5MVA
transformer bay to a complete transformer bay and replacing existing 5MVA transformer with
new 15MVA transformer. Among other things, it is suggested to change the whole 11 kV
switchboard and transformer panels.
3.12.1 Audit findings and the required remedial actions: Themis Substation

The audit found the following:
1. The substation has transformers and oil circuit breakers of 1988. This means by elimination method the substation can be classified as PCB free substation
2. Small oil leakage was observed on one of the circuit breaker
3. The substation is remotely controlled from Njiro substation. Hence no equipment was seen that may have contained chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly applied in Tanzania.
4. The substation has no oil containment thus oil leaks may contaminate underground water
5. The substation is earthed to minimize radiation and magnetic field effects
6. The substation is fenced to restrict access to the substation by unauthorized people
7. The substation needs remedial actions in the following areas:
   i. Repair of security lights, put more danger signs
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iii. Eliminate features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches
   iv. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) and ensure regular checks to find out whether they work or not
   v. Handling of hazardous and non hazardous material need to be improved especially in storage arrangement and prevention of oil spillage since there is no transformer containment
   vi. The substation needs yard cleanliness and appropriate waste handling and disposal practices
   vii. The substation need to have a toilet to be used by the security guards and people working on the site

3.13 Kiltex 33/11kV Substation

Kiltex substation (seen on photo 13:1-2 in Appendix 2) is located on Kilimajaro Textile (Kiltex) compound close to Tanzania Breweries Limited Arusha plant. It is in the industrial zone.

The substation is currently equipped with one 33/11kV, 5MVA transformer of 1966. The substation is connected by one 33kV line from Unga Limited substation. It holds equipment that though operational needs modification and replacement.

It is suggested to relieve the substation by either using the existing 33kV from Unga Limited dedicated to Kiltex only via 11kV bypass or build a new 11kV line from Unga Limited to pick up existing 11kV feeders then demolish the substation. Therefore, the new site for the new substation (New Kiltex) should be identified. If the final decision is to find the new site for this substation, then normal land acquisition procedures shall be followed including preparation of EIA of the site and Resettlement Action Plan (RAP) if relocation of people will be involved.
3.13.1 Audit findings and the required remedial actions: Kiltex Substation

The audit found the following:

1. The substation has transformers and oil circuit breakers of 1966 hence by cut off point (1980) it is classified as a PCB suspect. However, from the laboratory concentration tests results of the 61 samples taken from different substations, all suspected cases except two were found to be PCB free\(^6\), then in extreme probability the substation may also be PCB free or having transances of less than 50ppm.

2. Small oil leakage was observed.

3. No any equipment was found to contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is still widely used in Tanzania.

4. The substation has no oil containment for the installed transformer. This means any oil spillage will contaminate soil and eventually surface and underground water.

5. The substation is located between the Kiltex and brewery industries. It is remotely controlled with only a security guard on the site.

6. The substation is earthed.

7. The substation fenced but the fence need repair and warning signs to prevent the general public from electrocutions.

8. The substation needs improvement in the following areas:

   i. Repair of security lights, put more danger signs.

   ii. The substation need more gravels.

   iii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed.

   iv. Eliminate features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches.

   v. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder).

   vi. Handling of hazardous and non-hazardous material need to be improved especially in storage, arrangement, and prevention of oil spillage since there is no transformer oil leakage containment.

   vii. The substation need to have a security guard shade and a toilet to be used by the security guards and people working on the site.

   viii. The substation needs cleanliness and appropriate waste handling and disposal practices.

3.14 Mount Meru 33/11kV Substation

This substation (seen on photo 14:1-2 in Appendix 2) is located along the Moshi-Arusha road, not far from the Novel Tel Mount Meru hotel. It has one building that house batteries and control units. It is remotely controlled from Njiro substation. It drains water into a stream nearby.

\(^6\) The 2 cases found to be PCB contaminated had concentration between 350ppm and 405 ppm of Aroclor 1254 and Aroclor 1260 PCB compounds and are located in Dar es Salaam (K/North) and Kilimanjaro regions.
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The substation is currently equipped with two 33/11kV, 5MVA transformers manufactured in 1991. The 33/11kV transformers were supplied by EB National Industries of Norway. The 11kV switchboard is of indoor type.

The proposal is to upgrade the 33kV feeding line Njiro-Mount Meru to a double circuit. Hence it will require rebuilding the existing 1 x 5MVA transformer bay to a complete transformer bay and replacing existing 5MVA transformer by a new 15MVA transformer. The rehabilitation will also involve upgrading of Circuit Breakers and protection devices. Otherwise rebuilding the whole substation to the existing site as an indoor 33/11kV substation with one 33/11kV, 15MVA power with additional one as the load increases.

3.14.1 Audit findings and the required remedial actions: Mount Meru Substation

The audit found the following:
1. The substation has transformers of 1991 and SF6 circuit breakers hence classified as PCB free substation
2. No oil leakage was seen on any equipment
3. It has two window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is widely used in Tanzania for repair work. However, no disposable units were seen at the site
4. The substation has oil containment for all installed transformers
5. The substation is remotely controlled and only a security guard is available at the site. The substation is quiet except for the noise of passing vehicles
6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects
7. The substation fenced though it needs some repair warning signs to prevent the general public from electrocutions
8. The substation needs remedial actions in the following areas:
   i. Repair of security lights, put more danger signs
   ii. The substation need more gravels
   iii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iv. Improve drainage by cleaning the storm water trenches
   v. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) and ensuring regular checks to be sure that they are in good order ready for use
   vi. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of oil spillage
   vii. The substation need to have a security guard shade and a toilet to be used by the security guards and people working on the site
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viii. The substation needs yard cleanliness and appropriate waste handling and disposal practices

3.15 Unga Limited 66/33/11kV Substation (Power Station)

This substation (seen on photo 15:1-2 in Appendix 2) is located at Unga Limited area in the Arusha old power station compound. The substation receives energy from Kiyungi through the 66kV transmission line. It supplies energy to the industrial and residential areas. According to the consultant the equipment has reached its useful life and upgrading or rehabilitation makes no sense.

The substation has 66kV, 33kV and 11kV voltage levels bus bars. After receiving 66kV from Kiyungi it steps down to 33kV through the 66/33kV transformer. The substation is currently equipped with two 33/11kV, 5MVA transformers erected in 1966. There are other five off line transformers laying at the compound.

It is therefore proposed to rebuild the substation adjacent to the existing site as an indoor 33/11kV substation with one 33/11kV 15MVA power transformer with provision of adding the second one. It is further proposed to add one transformer bay, two 33kV feeder bays and provision of spare feeders.

3.15.1 Audit findings and the required remedial actions: Unga Limited Substation

The audit found the following:

1. The substation has transformers and oil circuit breakers of 1966 making the substation a PCB suspect. However the laboratory test conducted for two transformers in March 2004 by Stone and Webster did not find any traces of PCB compounds in the samples. This concludes that the existing transformer oil has been changed several times and the substation is PCB free

2. Oil leakage was seen almost on every transformer and breakers

3. No equipment was observed which may contain chlorofluorocarbons (CFCs), particularly R12 refrigerant commonly in AC repair work in Tanzania

4. The substation has no oil containment for the installed transformers. This means any spillage will contaminate the soil and eventually surface and ground water

5. The control room for the switchboard operators is not convenient for the working staff. In spite of having ventilation, the machine hall exposes operators to cold during cold times and lots of mosquitoes in other times. It has been very difficult to control the insects because the hall is too big. The machine hall needs to be compartmentalized to have sufficient and convenient rooms which can be easily controlled temperature-wise and insects-wise.

6. Noise wise the substation is quiet and does not need any ear protection against noise.

7. The substation is earthed and has protective shields to minimize radiation and magnetic field effects

8. The substation fenced but needs repair and warning signs to prevent the general public from electrocutions
9. The substation area has a lot of scraps laying in the machine hall (control room) and outside the machine building. Also some old scavenged machines are still fixed in the machine hall. These scraps need to be cleared up and appropriately disposed of.

10. The substation needs improvement in the following areas:
   i. Regular training of all personnel in safety & safety procedures, work procedures, accident and accident prevention and health risks
   ii. Availing more reference materials of which employees could refer to or improve their knowledge
   iii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed
   iv. First aid kit need to be furnished with important drugs and necessary equipment
   v. Fire fighting equipment are inadequate need to be adequately supplied in required proportions (foam, carbon dioxide, powder) and ensure a regular checks to be sure that they are ready for action
   vi. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of oil spillage since there is no transformer oil leakage containment
   vii. Repair of security lights is needed
   viii. The substation need more gravels
   ix. The substation's toilet condition needs to be improved for the convenience of workers in the substation
   x. The substation needs a compound cleansness and appropriate waste handling and disposal practices. The machine parts scraps need to be cleared at the substation and appropriately disposed

3.16 Kiyungi 132/66/33kV Substation
Kiyungi substation (seen on photo 16 in Appendix 2) is located about 8km to the South of the Moshi town centre on the left bank of the Kikafu River next to the large sugar cane estate. Kuyungi S/S is the main station in Moshi area connected to the 132kV system by the 132kV line from same-Hale and from Njiro S/S.

The S/station has one 132/66kV, 15MVA transformer of 1974 and one 132/33kV, 20MVA transformer of 1989. Also there are two 66/33kV, 5MVA transformers and one 66/33kV, 10MVA transformer of 1967. Different vector group are connected to the secondary side of the 132/66kV main transformer. Apart from SF6 circuit breakers, still there are some oil breakers mainly for 66kV and 33kV circuits dating back from 1967 to 1984.

The proposal is to exchange 132/33kV, 20MVA transformers by a 132/33, 50MVA transformer. It is also proposed to install 132kV bay to connect the new 132kV line from Kiyungi to Njiro S/S via Kilimanjaro International Airport (KIA). The 33kV outdoor substation shall be rehabilitated and extended or rebuild as a new indoor substation. For distribution system two additional 33kV
3.16.1 Audit findings and the required remedial actions: Kiyungi Substation

The audit found the following:

1. In this substation, the PCB concerns are the transformers dating back to 1974 and 1967. Transformers dating above 1980 are considered non-PCB transformers. It is believed that the retro filling, which has been going on in the substation, may have neutralized the concentration. The PCB study conducted by the Stone & Webster found out that out of four samples taken, three were found to contain traces of Aroclor 1254 and Aroclor 1260 compounds of PCB ranging from 0.5ppm to 205ppm. These values indicate that the oils have traces of PCB, hence PCB contaminated. The conclusion made from the sample result is that all suspected transformers dating back before 1980 are contaminated though in different concentration.

2. Oil leakage was seen on T1 and T2 breakers.

3. The substation has few window type air condition units, which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used in Tanzania in AC repair work. However, no disposable units were seen at the site.

4. The substation has oil containment for newly installed transformers but lacks the containment for the old installation. No oil leaks were seen on the transformers though. The site has no designated storage room for the oils instead it uses the regional stores.

5. The workroom is air conditioned to maintain workplace air quality and the room is quiet. The outside noise level is below 50dB during the day. No complaints has so far reported by residents over noise levels.

6. The substation is earthed and has protective shields to minimize radiation and magnetic field effects.

7. The substation is well fenced and has warning signs to prevent the general public from electrocutions.

8. The substation needs improvement in the following areas:
   i. Regular training of all personnel in safety & safety procedures, work procedures, accident and accident prevention and health risks.
   ii. Availing more reference materials of which employees could refer to or improve their knowledge.
   iii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed.
   iv. First aid kit need to be furnished with important drugs and necessary equipment.
   v. Fire fighting equipment are inadequate need to be adequately supplied in required proportions (foam, carbon dioxide, powder).
vi. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of spillage since there some transformer without oil leakage containment

vii. Avail portable water (dispensing unit)

viii. Maintain security lights, put more danger signs

ix. The substation needs cleanliness and appropriate waste handling and disposal practices

x. The substation needs more gravels

xi. Transformers found contaminated by PCBs exceeding 50ppm need special attention to prevent leakage. When their useful lives come to an end they should be safely disposed of

3.17 Boma Mbuzi 33/11kV Substation

This substation (seen on photo 17:1-2 in Appendix 2) is located along the TPC road. There are some residential houses nearby substation.

The substation is currently equipped with 2 33/11kV, 5MVA transformers of 1980. The substation is located north of Kiyungi and connected to the 33kV line Kiyungi – Boma Mbuzi – Rombo. It is suggested to rebuild the substation to the new 33/11kV standard. It is designed to cover the load in the surrounding areas and be the starting point for the 33kV line to Rombo and 11kV feeders to the surrounding areas.

It is proposed that the substation be an indoor 33/11kV equipped with one 33/11kV 15MVA power transformer with a provision to add a second transformer. It further proposed to add a full 33kV transformer bay, two 33kV feeder bays, one equipped spare bay and space for four additional feeders.

3.17.1 Audit findings and the required remedial actions: Boma Mbuzi Substation

The audit found the following:

1. The substation has transformers and oil circuit breakers of 1980. This means by elimination method the substation can be classified as PCB free substation

2. No oil leakage was observed neither on the circuit breaker nor transformers

3. The substation is remotely controlled from Kiyungi substation. Hence no equipment that may have contained chlorofluorocarbons (CFCs) was seen on the site particularly R12 refrigerant which is commonly applied in Tanzania.

4. The substation has no oil containment thus oil leaks may contaminate underground water

5. The substation is earthed to minimize radiation and magnetic field effects

6. The substation is fenced to restrict access to the substation by unauthorized people however, it needs repair

7. The substation needs improvement in the following areas:

   i. Repair of security lights, put more danger signs
ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed

iii. Eliminate features that put safety in danger by repairing or replacing broken or missing slabs on cable trenches and improve the drainage system

iv. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) and ensure regular checks to be sure that they are in order ready for use

v. Handling of hazardous and non-hazardous material need to be improved especially in storage arrangement and prevention of oil spillage since there is no transformer containment

vi. The substation needs cleanliness and appropriate waste handling and disposal practices

vii. The substation needs to have security guard shade and a toilet to be used by the security guards and people working on the site

3.18 Trade School 33/11kV Substation

This substation (seen on photo 18:1-2 in Appendix 2) is located off Moshi-Arusha road near the junction to Bonite Bottlers Limited. It seemed to have switchboard & control room building and fencing rehabilitated recently.

The substation is currently equipped with one 33/11kV, 5MVA transformer of 1975 and one 33/11kV 1MVA of 1983. According to the technical consultant the substation has reached its useful life and needs to be rebuilt.

It is proposed to rebuild the substation as an indoor 33/11kV substation with one 33/11kV 15MVA power transformer with a provision of adding a second transformer. It is further proposed to add a full 33kV transformer bay, three 33kV feeder bays, one equipped spare feeder bay and space for three additional feeders.

3.18.1 Audit findings and the required remedial actions: Trade School Substation

The audit found the following:

1. The substation has transformers and oil circuit breakers of 1983 and 1975. This makes the substation a PCB suspect on one transformer. As general observation the substation may be PCB free or contaminated based on the studies made in March 2004 by Stone & Webster and July 2004 by Vice President’s Office

2. Oil leakage was observed on the transformers which were off the circuit that are waiting the disposal

3. The substation is remotely controlled from Kiyungi substation. Hence no equipment was seen that may have contained chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly applied in Tanzania

4. The substation has no oil containment thus any oil leaks will contaminate soil and eventually surface and underground water
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5. The substation is earthed to minimize radiation and magnetic field effects
6. The substation is fenced to restrict access to the substation by unauthorized people
7. The substation needs improvement in the following areas:
   i. Erect security lights and put more danger signs
   ii. Supply of adequate fire fighting equipment in right proportions (foam, carbon dioxide, powder) and ensure a regular checks to be sure that they are in order ready for use
   iii. Handling of hazardous and non hazardous material need to be improved especially in storage, arrangement and prevention of oil spillage since there is no transformer containment
   iv. The substation needs cleanliness and appropriate waste handling and disposal practices
   v. The substation needs to have a security guard shade and a toilet to be used by the security guards and people working on the site
   vi. For further expansion an extra land will be required

3.19 Chalinze 132/33kV Substation
This substation is located at Chalinze on the left hand side of the Dar - Morogoro road. The substation has two transformers which are not working due to some malfunctioning. One is rated 132/33kV; 10MVA was manufactured in 1962 and the other is 132/33kV; 5MVA also of 1962.

It is proposed to upgrade the substation by installing two new power transformers in the range of 10MVA together with switchgears. Other tasks will include changing the circuit breakers, current transformers, protection and control devices, supporting structures, adding surge arrestors on all line feeders. Also the civil works will cover the upgrade of the internal and external fence, substation drainage system and the building.

3.19.1 Audit findings and the required remedial actions: Chalinze Substation
The audit found the following:
1. The sub station has transformers and oil circuit breakers of 1962. Hence by elimination method (i.e. transformers and switchgears made after 1980 are classified as PCB free) the substation is -PCB suspect. However the weight of the oil is 25,800 British pounds (11,727.3 kg) and volume of the oil is 2,990 British gallons (13,593 litres), which means the density of the liquid oil (11,727.3 kg/13,593 lts = 0.86 kg/lts3) is less than the density of water (note: density of PCB oil is heavier than water i.e. 1kg/lts3)
2. There was an oil leakage in one transformer
3. It has three (3) window air conditioning units which may contain chlorofluorocarbons (CFCs) particularly R12 refrigerant which is commonly used in Tanzania for repair works
4. The substation has no transformer oil containment to prevent oil from contaminating the soil and ground water in case of spillage. Spare oil is stored in the above ground tank which also has no any containment apart from gravels
5. The substation noises come from the passing vehicles which is hardly heard when you are in the control room. Hence it is not dangerous to the workers.

6. The substation is fenced and has warning signs to prevent the general public from electrocutions.

7. The substation has poor drainage which needs to be improved.

8. The substation needs improvement in the following areas:
   i. Improvement in general cleanliness of the substation and removal of scraps.
   ii. Emergency preparedness, prevention and response plan needs to be prepared and rehearsed. A summary of important items of the plan need to be hanged on the wall for the reference of everyone.
   iii. A toilet needs some repairs to be in a standard condition and a security guard kiosk is also needed. In addition, broken or missing cable trench slabs need to be replaced.
   iv. Fire fighting equipment is inadequate need to be adequately supplied in the required proportions (foam, carbon dioxide, powder, etc.) and recharged when expire.
   v. Personal protective equipment such as helmets need to be supplied.
   vi. Training of personnel is needed. One person attended a course 20 years ago but others have not attended any course.
   vii. Improvement in waste handling.
   viii. The substation needs more gravels.
   ix. Work procedures and safety guidelines need to be available in a known language to substation operators.

3.20 Public Concerns (Substation)

The major concern of the public regarding the substations was a health risk due to electromagnetic effects. Although there is no proof yet of the effect here in Tanzania, people raised their fear based on the information available in the Internet. The World Health Organization (WHO) guidelines however, suggest that the level should not exceed 5000V/m. There were no complaints or concerns about the noise levels around the substations. Up to now no any complaints have been received or reported to Substation authorities during the course of the study.

Note: TANESCO shall perform a laboratory analysis of the soil samples under the transformers suspected of PCBs in the year 2006 budget. When the fund becomes available and the laboratory capable of delivering the required analysis locally is found the soil samples shall be taken for the analysis.

3.21 Prioritised Audit Findings and Recommendations

Below are the prioritised audit findings and recommendations. These facilities will comply with the World Bank minimum standard requirement after correction of the observed weaknesses and shortcomings in the following areas in the order of high concerns- high priority and lower concern- lower priority:

High concern – High priority
1. The environmental management and auditing is centralized at TANESCO Head Office but is implemented on site by the responsible regions or plants. **TANESCO should strengthen environmental management both at Head Office Environmental Unit and at the implementing Regions or plants.**

2. Waste management and handling was also seen to be a problem in most substations. Pieces of solid wastes and scraps had no specific and designated area for collection and eventual disposal. **Facilities (substations) should designate special areas (points) for waste collection and collect all unwanted scraps for a safe disposal. Wastes on substation site such as pieces of cables and other wastes could have special bins.**

3. Almost all of the transformers in use in the audited substations owned by TANESCO can be classified as non-PCB. This is because among the samples sent for the laboratory tests from the audited areas, PCB was not detected or was below 50 ppm. In one substation traces of PCB of less than 500 ppm cut off point compounds were detected in transformers (i.e. some transformers are PCB contaminated). This might be of concern to the World Bank. **However, the Vice Presidents Office (VPO) has labelled all these transformers and they are not allowed to be moved from where they located without the permission from the VPO office. As these identified transformers are waiting for the National Strategic Plan to eliminate POPs TANESCO should ensure that they are not moved from where they are and substation engineers should ensure that there is no leakage to the soil or water. In addition there should be appropriate oil handling at all times.**

4. In some substations, some of the old transformers dumped at substation sites have oil leakages, which contaminate the soil. **TANESCO (Regional Offices) should collect these transformers and dispose them or store them in appropriate designed area that contains or prevent the oil leakage to the soil. For all new transformer installations transformer oil containments should be considered.**

5. Fire fighting equipment is inadequate in right proportions (foam, CO₂, powder). **TANESCO should provide adequate fire fighting equipment in a right proportion (foam, CO₂ and powder) to fight any fire types in the substations.**

6. Environmental Management Plan and Monitoring of the substations is absent. **TANESCO should implement the prepared EMP and provide resources estimated at least USD 10,500 annually for monitoring plan.**

7. Some of the cable trench slabs are broken or missing thus causing a safety risks at night and in case of emergency. **TANESCO Regional Offices should plan the budget and urgently replace all lost or broken lids and slabs.**

8. First aid kit is not equipped and lack essential drugs. **Substation engineers in collaboration with Regional Offices should reequip the First aid kits as required.**

9. Some of the substations have their fences damaged, security lights not working and their danger signs missing or worn out. **TANESCO should ensure that damaged fences are**
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Repaired, security lights work again and all danger signs are replaced to prevent and warn the public of potential danger as they approach the fences.

10. There is no clear identification of who has been assigned responsibility of taking care for the environmental matter of the substations. **There is a need to assign responsibility to a substation engineer who has to report performance in monthly report**

Medium Concern – Medium priority

11. Except for Njiro, Kiyungi, Ilala, and FZ III, which have askari kiosks and toilets majority of the substations, have no such facilities. Security guards have got neither shade nor toilets making their work difficult and dangerous in some cases such as rain season or at night. **TANESCO is required to provide such facilities at the workplace for the convenience of workforce. It is recommended that security guard kiosks and toilets should be constructed for those, which don’t have, and for those such as Sokoine city centre and Oyster Bay, which have the kiosks but toilets are out of order, should be restored and maintained.**

12. Working procedures and instructions are missing. **TANESCO and substation Engineers should prepare work procedure manuals and instructions and make them available to all substation workers**

13. Emergency preparedness, prevention and response plan was seen to be lacking in all substations audited in case of fire, major accident or major oil spills. Although some substations had radio calls and telephone lines no clear line of communication in case of emergency was seen. **TANESCO needs to prepare an emergency response plan. The plan should be frequently practiced (hold regular drill to check whether the plan performs as intended) and each employee should know all the information flow in case of the emergency. Information flow charts should be posted at a visible place.**

14. Although training has been taking place in TANESCO, trainings specifically designed for substation engineers, technicians and operators have been scarce and limited to very few individuals. **TANESCO (Head office which coordinates employees’ trainings in cooperation with regional offices) needs to organise regular courses (tailor made training programs to suit different cadres of substation employees and others) such as training on work procedures, health and safety matters, hazardous material handling and emergency preparedness and response.**

15. Oil spill is not a big problem in many substations. However, improvement in oil handling during maintenance is required to all employees working in the substations. **Substation engineer and maintenance supervisor should ensure oil handlers improve the oil handling to prevent oil spillage during filling up of Oil Circuit Breakers (OCBs) and transformers or during retro filling and filtering the oil and all oil leaks from transformers and switchgears are contained.**

16. TANESCO has so far no formalized Environmental Management System (EMS) though it has a unit, which deals with environmental matters. The Major bottleneck to undertake the environmental programs is lack of budget. **TANESCO has to develop and EMS suitable to**
its activities or adopt ISO 14000 standard in order to improve its environmental management performance. In addition fund for implementing management plans should be made available.

17. Public Concern: the major concern of the public was a health risk due to electromagnetic effect. No noise complaints or concerns were reported during the survey. TANESCO should measure the radiation and control the level to the WHO acceptable range which is below 5000 V/m.
Chapter 4
Environmental Management Plan

Construction and operation of the substation may have various impacts to the environment. Environmental Assessment as a management tool could be used to identify the impacts before the construction of a substation. However, the audit assessment found no records showing that there was any environmental impact assessment for the substations. This may be due to the fact that majority of these substations were constructed more than 20 years ago when EIA was given little attention. The audit study has identified the environmental impacts that are likely to occur in the construction and operation of the substation. The significance of these impacts may be reduced if mitigation measures and monitoring are put in place. This chapter provides a summary of impacts, mitigation measures and monitoring plan.

In order to ensure that there is a system to track compliance with the WB and Government of Tanzania policies; Laws and guidelines, TANESCO have to commit itself and ensure that it establishes the Environmental Management System (EMS). The advantages of having the EMS at TANESCO include: having people who are responsible for ensuring environmental management, having a systematic way of tracking the environmental problems and addressing them in all aspects of company activities, having proper records and assignment of budget to environmental programs.

The project document for the EMS establishment within TANESCO is appended.

Table 4.1: Summary of Environmental Impacts and Proposed Mitigation Measures

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Accountability or Responsible Institution</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Waste generation (rehabilitation and operation phases)</td>
<td>Oil spillage from leaking transformers and switchgears and from oil mishandling in the substations could contaminate soil, surface and underground water risking ecosystem and surrounding community</td>
<td>Contain all transformers and switchgear oil leaks and construct beams (Sumps) under the transformers to hold oil leakages until remedial measures are taken to prevent oil spillage to the ground</td>
<td>TANESCO HQ. and Regional Offices</td>
</tr>
<tr>
<td></td>
<td>Refuse from office comprising of papers, plastic bags and non durable solids can litter the surroundings</td>
<td>Designate special refuse and waste collection points (bins) and contract with authorized waste collection companies or authorities (Municipals) for right disposal</td>
<td>TANESCO Regional Offices</td>
</tr>
<tr>
<td></td>
<td>Waste pieces, metal scraps, porcelain glass materials scraps can be safety hazard to worker and the community</td>
<td>Metal craps should be sold to scrap buyers and any other wastes collected for safe disposal</td>
<td>TANESCO HQ. and Regional Offices</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Accountability or Responsible Institution</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Water Pollution (Operation phase)</td>
<td>Oil spillage during maintenance and oil leaks from transformers and oil circuit breakers can pollute surface and underground water</td>
<td>TANESCO HQ. and Regional Offices</td>
<td>During the maintenance</td>
</tr>
<tr>
<td></td>
<td>• Improve oil handling practices and prevent oil leaks from seeping to the soil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Noise pollution (Rehabilitation and operation phases)</td>
<td>Excessive noise may cause disturbance and discomfort to the community surrounding the substation and may also cause hearing impairment in extreme cases</td>
<td>TANESCO HQ. and Regional Offices</td>
<td>Annually</td>
</tr>
<tr>
<td></td>
<td>• Noise levels should be monitored to ensure that they are within the World Bank guidelines, i.e. 70dB in industrial setting and 45dB in residential areas along the substation boundaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Occupational Health and Safety (Rehabilitation and operation phases)</td>
<td>There is potential risks of work related injuries, accidents, electrocution and contamination with hazardous materials</td>
<td>TANESCO HQ/ Regional Offices/ Substation Supervisors/ Engineer</td>
<td>Daily</td>
</tr>
<tr>
<td></td>
<td>• Train the employees on work procedures, health and safety and provide the manuals</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provide employees with personal protective gears</td>
<td>TANESCO HQ. and Regional Offices</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Provide the first aid kits to every substation</td>
<td>Substation supervisor</td>
<td>Annually</td>
</tr>
<tr>
<td></td>
<td>• Keep records of accidents and review the work procedures</td>
<td>Substation supervisor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Ensure that the personal protective gears are applied as required</td>
<td>TANESCO HQ. and Regional Offices and S/S management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Enclose the S/S to restrict access to all areas potential to electric shocks and high voltage. Entrance should be with special permission to only well informed and aware people of the potential risks and how to avoid</td>
<td>TANESCO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Employer to provide a safe working environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Employer should provide welfare facilities such as toilets, drinking and washing water and other hygienic requirements</td>
<td>TANESCO/ Regional Offices/</td>
<td></td>
</tr>
</tbody>
</table>

Environmental Audit Report - Final
## Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

### Impacts and operation phases

<table>
<thead>
<tr>
<th>Oil leakage can cause water and soil contamination affecting livelihood of the surrounding community and the effect on flora and fauna</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformer should have retaining walls to prevent spilled oil to contaminate the soil, surface and underground water</td>
</tr>
<tr>
<td>Maintenance technicians and other employees working in the substation should handle oil properly during maintenance and during transformer and switchgears refills</td>
</tr>
<tr>
<td>Leaking transformers and switchgears should be maintained to prevent further leaks</td>
</tr>
<tr>
<td>TANESCO Regional Offices/Substation Supervisors/Engineer</td>
</tr>
<tr>
<td>During installation of new transformers</td>
</tr>
<tr>
<td>S/S management (engineer and supervisor)</td>
</tr>
<tr>
<td>During maintenance</td>
</tr>
<tr>
<td>TANESCO HQ., Regional Offices and S/S management</td>
</tr>
</tbody>
</table>

### 6. Emergencies (Rehabilitation and operation phases)

**Fire**
Faulty electrical system, transformers overload and other human errors may cause fire which can destroy property and cause loss of life.

- TANESCO should provide appropriate and adequate fire extinguishers for all types of fires
- Train the employees on how to use the extinguishers and type to be used for each type of fire. Also rehearse to check if employees can respond effectively in actual fire emergencies
- Provide fire safety manuals if possible to the language known to every employee
- TANESCO HQ. and Regional Offices
- TANESCO HQ. and Regional Offices
- TANESCO HQ. and Regional Offices
- Annually

**Accidents**
Accidents may occur at any time causing injury, death or environmental damage.

- Establish clear line of communication of all parties concerned
- Prepare an emergency plan and rehearse to ensure that the plan works as intended
- Prepare emergency plan manuals and emergency procedures
- TANESCO HQ. and Regional Offices
- TANESCO HQ. and Regional Offices (Police/Hospitals/Fire and Rescue department)
- TANESCO (Safety department)
- Annually

### 7. Electrocution (Rehabilitation and operation phases)

Substations are place where normally there are high voltages, which kill instantly by just a single touch. This place may be dangerous to the public and community living nearby.

- Enclose all substations to restrict access to unauthorized people
- Put warning signs to alert all members of the public over the potential dangers of touching the
- TANESCO HQ. and Regional Offices
### Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Accountability or Responsible Institution</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>fence or breaking inside the fence</td>
<td>People working on the site during the rehabilitation work must be aware of the potential dangers while working in the substation and appropriate work procedures must be strictly followed and enforced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Sewage (Rehabilitation and operation phases)</td>
<td>TANESCO and contractor should ensure that good sanitary conditions are provided to the workforce in the substations. In addition appropriate disposal of the sewer wastes is done by approved person in accordance with the town, municipal or city regulations</td>
<td>TANESCO HQ. and Regional Offices</td>
<td>Quarterly</td>
</tr>
<tr>
<td>Workers on the substations generate sewer wastes. Hence inappropriate disposal of sewage, which has pathogens responsible for diseases such as diarrhoea, dysentery, cholera, etc., can result to such deceases to the workers themselves and the community around</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Need for extra land (Rehabilitation phase)</td>
<td>Utilize the existing land whenever possible based on available technology and cost. Acquire the new land following the land acquisition procedures (compensation and preparation of resettlement action plan – RAP)</td>
<td>TANESCO HQ. and the selected design contractors</td>
<td>During planning</td>
</tr>
<tr>
<td>Need for the extra piece of land for substation expansion may lead to relocation of people in some substations</td>
<td></td>
<td>TANESCO HQ., Ministry of Lands and Human Settlement Development, Regional Offices and affected people</td>
<td>Before the implementat ion of the project</td>
</tr>
<tr>
<td>Decommissioning stage</td>
<td>Land which has been polluted must be cleaned so as to return it to its original state to allow other land uses. All contaminated soil must be treated and disposed of or safely stored to prevent further pollution. (note that soil with PCBs need special treatment) If the land is to remain abandoned then it must be re-vegetated</td>
<td>TANESCO HQ and regional offices</td>
<td>When the useful life of the substation becomes to an end.</td>
</tr>
<tr>
<td>Polluted land</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wastes</td>
<td>All solid wastes at the site are to be removed from the site for safe disposal (these include old batteries, transformer windings and casing, insulator materials, etc.)</td>
<td></td>
<td>When the useful life of the substation</td>
</tr>
</tbody>
</table>
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

<table>
<thead>
<tr>
<th>Impacts</th>
<th>Mitigation Measures</th>
<th>Accountability or Responsible Institution</th>
<th>Monitoring Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid wastes such as transformer oil must be emptied from the transformers re-used at other sites if it is good or otherwise send it to specialized practitioners for safe destruction. Alternatively store it safely while waiting for the further decisions to be made.</td>
<td>becomes to an end.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TANESCO shall commit itself to ensure that the above mitigation measures are fully funded through its operational budgets

Table 4.2: Proposed Environmental and Social Monitoring Plan (ESMP) for the Construction and Operation of the Substations

<table>
<thead>
<tr>
<th>Impact/Issue</th>
<th>Monitoring Action</th>
<th>Frequency/Time Frame</th>
<th>Responsible Institution</th>
<th>Indicative costs In USD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rehabilitation and Operation</strong></td>
<td>* Monitoring of nuisance of dust during site preparation for new transformer foundations*</td>
<td>Daily during construction and installation</td>
<td>Contractor/ TANESCO S/S supervision</td>
<td>500</td>
</tr>
<tr>
<td>Air Quality (Dust nuisance)</td>
<td>* Monitoring of noise levels in dB (A) to ensure compliance with WB guidelines after any major facility maintenance or installation*</td>
<td>Soon after rehabilitation work and Annual check up for compliance</td>
<td>Contractor/ TANESCO TANESCO HQ and NEMC</td>
<td>500</td>
</tr>
<tr>
<td>Noise resulting from overloaded transformers and during rehabilitation work</td>
<td>* Monitor transformer and switchgear oil storage, oil spills, leakage and any oil mishandlings*</td>
<td>Daily and during the maintenance</td>
<td>Contractor/ TANESCO TANESCO HQ and NEMC</td>
<td>500</td>
</tr>
<tr>
<td>Water Pollution and soil contamination</td>
<td>* Check environmental awareness of substation employees to ensure that they abide by the principles of environmental protection*</td>
<td>Annually</td>
<td>TANESCO HQ and NEMC</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>* Take water and soil samples for laboratory testing (specifically for substation close to the water bodies) to check the compliances*</td>
<td>Annually</td>
<td>TANESCO HQ and NEMC</td>
<td>1,000</td>
</tr>
<tr>
<td>Waste Management</td>
<td>* Monitor collection and removal of all wastes at the sites and dispose them appropriately*</td>
<td>Monthly</td>
<td>Contractor/ TANESCO Regional Offices or S/S supervisor</td>
<td>500</td>
</tr>
</tbody>
</table>
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

<table>
<thead>
<tr>
<th>Impact/ Issue</th>
<th>Monitoring Action</th>
<th>Frequency/ Time Frame</th>
<th>Responsible Institution</th>
<th>Indicative costs in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health and Safety of Workers</td>
<td>• Monitor the providence and use of personal protective gears</td>
<td>Daily and annual checkups</td>
<td>Contractor and TANESCO/Substation supervisors</td>
<td>500</td>
</tr>
<tr>
<td></td>
<td>• Monitor the use of personal protective gears, work procedures and injury reporting mechanism</td>
<td>Daily and annual checkups</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Monitor implementation of workers health and safety procedure, First Aid Kit management and training program</td>
<td>Annually</td>
<td>TANESCO HQ and NEMC</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>• Monitor and review occupational injury and illness reporting and response to injury or accidents (injury and accident investigation program)</td>
<td>Annually</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Monitor and review emergency response Plan performance</td>
<td>Annually</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compliance with Laws, regulations and guidelines</td>
<td>• Monitor compliance of all applicable permits and guidelines.</td>
<td>Annually</td>
<td>TANESCO HQ, Regional Offices and NEMC</td>
<td>2,000</td>
</tr>
<tr>
<td></td>
<td>• Monitor and maintain lines of communication with all relevant government institutions, agencies on issues of environment, water use, health and safety, fire, accidents, etc.</td>
<td>Annually</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Education and Training</td>
<td>• Monitor Power Station TANESCO staff training program to verify compliance with substation training requirements (work procedures, safety issues, emergency preparedness, health risks, environmental awareness, reporting, working in confined spaces, etc.)</td>
<td>Annually</td>
<td>TANESCO HQ, Regional offices and NEMC</td>
<td>1,500</td>
</tr>
<tr>
<td>Decommissioning</td>
<td>• Monitor that the land is returned to its original state that would allow other land uses</td>
<td>End of operation phase</td>
<td>TANESCO HQ, Regional Offices, NEMC and Municipal Authorities</td>
<td>3,000</td>
</tr>
<tr>
<td></td>
<td>• Monitor that all contaminated soil is removed and replaced with a good soil (note that soil with PCBs need special treatment by specialized process)</td>
<td>End of operation phase</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Monitor re-vegetation of the land</td>
<td>End of operation phase</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

<table>
<thead>
<tr>
<th>Impact/Issue</th>
<th>Monitoring Action</th>
<th>Frequency/Time Frame</th>
<th>Responsible Institution</th>
<th>Indicative costs In USD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastes</td>
<td>• Monitor that all solid wastes from the site are removed and ensure that they are safely and appropriately disposed of (these include old batteries, transformer windings and casing, insulator materials, etc.)&lt;br&gt;• Monitor that all liquid wastes such as transformer oil are removed from the site for safe storage or treatment. Good oil can be re-used in another site.</td>
<td>End of operation phase</td>
<td>TANESCO HQ., Regional Offices, Decommission Engineer, NEMC and Municipal Authorities</td>
<td>2,000</td>
</tr>
</tbody>
</table>

A total estimated cost for implementing this ESMP is USD 11,000 annually and USD 5,000 during the decommissioning process. This amount of money shall be made available by TANESCO. The costs are for the monitoring exercise staff from TANESCO head office, Regional offices and National Environmental Management Council (NEMC) experts, transport, laboratory and monitoring equipments. NEMC is included in the monitoring phase as an independent body with a given authority to monitor environmental compliance and according to the conditions of the environmental license.

TANESCO is committed to follow the country’s policies and continue to communicate with relevant sectors and ministries to ensure that environment is protected and health and safety of workers and people around our facilities is guaranteed.

TANESCO shall prepare monitoring reports regularly and submit the same to the relevant authority as require by EMA (2004).

TANESCO shall provide environmental education to its staff of all levels to ensure environments at work places are protected.

TANESCO shall maintain the line of communication to all people with any concerns (social or environmental) and complaints about our facilities.
Chapter 5

Conclusion and Recommendations

The overall conclusion is that majority of the substations meet the World Bank minimum requirement with only few minor corrections. The remedial costs are to be covered in Regional repair and maintenance budgets. It is proposed that Regional offices review the document to understand the shortcomings of the substations in their area and workout the actual budgets to be approved by the regional administration.

It is the responsibility of TANESCO Regional Offices of which these substations fall in the area of their jurisdiction to ensure that they do corrective measures so as to fully comply with the World Bank minimum requirement. TANESCO Head Office shall provide assistance whenever necessary to the regional offices.

1. TANESCO should strengthen environmental management both at Head Office Environmental Unit and at the implementing Regions or plants

2. Since TANESCO has so far no formalized Environmental Management System (EMS) in spite of having an environmental unit, which deals with environmental matters. Then TANESCO has to develop an EMS suitable to its activities or adopt ISO 14000 standard in order to improve its environmental management performance. In addition, fund for implementing management plans should be made available

3. Although training has been taking place in TANESCO, trainings specifically designed for substation engineers, technicians and operators have been scarce and limited to very few individuals. TANESCO (Head office which coordinates employees’ trainings in cooperation with regional offices) needs to organise regular courses (tailor made training programs) to suit different cadres of substation employees and others. Such as training may include work procedures, health and safety matters, hazardous material handling and emergency preparedness and response

4. Since it was observed that no clear identification of who has been assigned responsibility of taking care for the environmental matters of the substations. Therefore, substation engineers or supervisors should be assigned also such a responsibility and required to report performance in monthly reports

5. TANESCO needs to prepare an emergency response plan in the event of fire, major accident or major oil spills. All audited substations didn’t have the plan. Workers need to rehearse and understand the information flow in case of the emergency so as to check whether the plan works as intended. Information flow charts should also be posted at a visible place

6. Waste management need to be improved in all the substations as this was seen to be a problem in most substations. Substation management should designate special areas (points)
for waste collection before safe disposal. Special bins can be used to store collected wastes such as pieces of cables, insulators and other wastes in the substation site before disposal.

7. Raise awareness of people working in the substation on the potential hazard of oil spill to the environment and how to handle it appropriately during refilling, oil filtering or maintenance.

8. TANESCO Regional Offices are required to provide toilets and askari kiosk facilities in the substations for the convenience of workforce. There are some which need repair and some which need to be constructed. With exception of Njiro, Kiyungu, Ilala, and FZ III all other substations lack toilet, askari kiosk or both.

9. TANESCO (Regional Offices) should collect all old transformers dumped at substation sites which some of them have oil leakage and dispose them or store them in appropriate designed areas that may contain or prevent the oil leakage into the soil.

10. TANESCO should provide adequate fire fighting equipment in a right proportion (foam, CO₂ and powder) to fight any fire type in the substations and ensure that equipment are regularly checked to be sure that they are working properly. Some substations had inadequate fire fighting equipment or right proportion.

11. TANESCO departments and substation engineers should prepare work procedure manuals and instructions where such instructions are very essential and make them available in a known language to all substation workers. Many substations had no working procedures and instructions at all or had instruction written in a language not understandable by majority.

12. TANESCO should provide resources estimated at least USD 11,000 annually to facilitate implementation of the proposed ESMP and monitoring plan. Other mitigation costs will be covered in construction costs.

13. TANESCO Regional Offices should budget and urgently replace all lost or broken lids and slabs to improve the safety in the substations as some of the cable trench slabs were found broken or missing increasing a safety risks at night and in emergency cases.

14. TANESCO’s substation engineers in collaboration with their Regional Offices should reequip the First aid kits as required since most of first aid kits are not equipped with essential drugs.

15. TANESCO should ensure that transformers identified having PCB contamination (below 500ppm) are not moved from where they are located. In addition substation engineers should ensure that there is no leakage to the soil or water. Further there should be appropriate oil handling at all times while waiting for the national strategic plan to eliminate POPs prepared by the Vice Presidents Office (VPO).

16. TANESCO should ensure that fences are repaired, security lights working again and all danger signs replaced to alert people of the potential dangers as they approach the fences.
Bibliography


8) SAPP, Draft SAPP Guidelines on the Management of Oil Spills, 2004


11) Vice President’s Office, PCB Inventory Project, Field Testing data sheets for Dar es Salaam, Arusha and Kilimanjaro, June-August 2004.


APPENDIX 01: CHECKLIST
<table>
<thead>
<tr>
<th>GUIDELINES CONSIDERED</th>
<th>NJIRO LIMITED</th>
<th>UNGA LAWATE</th>
<th>KILTEX</th>
<th>THEM</th>
<th>MOUNT MERU</th>
<th>KIYUNGI</th>
<th>LAWATE</th>
<th>BOMA MBUZI</th>
<th>TRADE SCHOOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Power Transmission and Distribution</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>PCBs Oils in transformers and switch gears</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Transformers with PCB</td>
<td>X</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Switchgear with PCB</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Safe disposal of PCB oil</td>
<td>NA</td>
<td>NA</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>• Labelling</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>• Oil leakage</td>
<td>✓ small</td>
<td>✓ small</td>
<td>✓ OCB</td>
<td>✓</td>
<td>✓ T1,T2</td>
<td>✓ OCB</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Retrofilling</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>• Transport (restriction)</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Storage</td>
<td>NA</td>
<td>NA</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>• Fire prevention</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>• Security (fencing)</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Equipment with Chlorofluorocarbons (CFCs) or Halon</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Window type Air Conditioning and refrigerators may contain R12 which is a common and cheap refrigerant in use in the region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Presence of equipment in use which may contain CFCs (AC, refrigerator)</td>
<td>✓ AC</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>✓ AC</td>
<td>✓ AC</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>• Safe disposal of equipment with CFCs</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>X</td>
<td>X</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>GUIDELINES CONSIDERED</td>
<td>NJIRO</td>
<td>UNGA LIMITED</td>
<td>KILTEX</td>
<td>THEM</td>
<td>MOUNT MERU</td>
<td>KIYUNGI</td>
<td>LAWATE</td>
<td>BOMA MBUZI</td>
<td>TRADE SCHOOL</td>
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<td>-------------</td>
</tr>
<tr>
<td>Storage of liquid fuels, raw and in process materials, solvents, wastes: to prevent spills, to prevent soil contamination and to prevent ground and surface water contamination.</td>
<td>✓ New instal.</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>✓ New instal.</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>• Containment, Dikes and Berms (e.g. for transformers)</td>
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<td>BOMA MBUzi</td>
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<td>✓ Overload relief</td>
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<td>✓ Noise below the limits</td>
<td>✓ Noise below the limits</td>
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<td>Levels below 85</td>
<td>X levels are below limits</td>
<td>X levels are within limits</td>
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Other physical Agents
- Safe working area (absence of radiation, magnetic fields)
  ✓ Earth
- Monitor regularly for radiation and field levels and equipment integrity (earthing, Protective shields, lockouts, etc)
  ✓ Earth

Electrocution
- Strict procedure for de-energizing before working on electrical equipment
  ✓ RC
- Training of personnel for safety procedures
  ✓ RC

Occupational Health and Safety Guidelines
Physical factors in the workplace
- Signage
  ✓ X imprv. X improv X improv X improv ✓ improv ✓ X improv ✓
- Lighting (including security lights)
  ✓ X maint. X improv X repair X repair ✓ repair - ✓ X repair ✓
- Fire detection mechanism/equipment
  X X X X X X
- Fire fighting equipment
  ✓ imprv ✓ imprv X ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv
- Cleanliness (inside and outside S/S)
  ✓ ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv ✓ imprv

3
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<td>Features that pose safety risks (missing or broken slabs, dagged holes, etc)</td>
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**Environmentally Audit Checklist for Dar es Salaam Substations**

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### SUBSTATIONS and Voltage Transformation GUIDELINES CONSIDERED

- **ILALA SOGOTNE CITY**
- **MUKURU BEACON OYSTER FZONE**
- **ZONE II**
- **ZONE III**
- **ZONE IV**
- **ZONE V**

#### Equipment with Chlorofluorocarbons (CFCs) or Halon
- Refrigerators may contain R12 which is a common and cheap refrigerant in use in the region.

#### Safe disposal of equipment with CFCs
- Oil storage: X X X NA NA X
- Control: OK X
- X poor
- Drainage: V Ok
- None
- AC

#### Storage of liquid fuels, raw and in-process materials, solvents, wastes:
- To prevent spills, to prevent soil contamination, and to prevent ground and surface water contamination.

#### Containment, Dikes and Berms
- (e.g. for transformers)
- NA NA NA NA

#### Containing, Dikes
- NA NA NA NA

#### Berms
- NA NA NA NA

#### Control
- NA NA NA NA

#### Maintenance of air quality
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Monitoring of workplace air quality
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Good ventilation (ensure)
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Work Place Air Quality
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Need for extra greed
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Drainage
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Oil leakage
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Storage facility
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Containment of oily water
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.
- Only a guard is on security.

#### Control
- Only a guard is on security.
- Only a guard is on security.
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</table>

- **Enforcement of the application of personal protective equipment whenever exposure levels of fumes, solvents and other materials exceed threshold limits**
  - X on the site
  - X on the site
  - X on the site

- **Work place Noise**
  - Noise control equipment
  - **World Bank limit levels**
    - Ambient Noise
      - Day: 55 dB
      - Night: 45 dB
    - Residential: 70 dB
    - Industrial: 70 dB
    - *Noise control equipment*
      - Levels within limits: 55 dB
    - Noise level below the limit: The S/S is RC. Noise level is below 70 dB limit
    - Noise within the limits: The S/S is RC, Noise level is 47 dB
    - *Noise is RC, Noise level is 47 dB*
    - The average noise level is 47 dB
    - Average noise level is 56 dB
    - Noise levels within the limits: The S/S is RC, Noise levels are below 70 dB limit
    - X level is 48 dB

- **Maintenance of equipment**
  - Overload Relief
    - Overload Relief

- **Use of protection gears when noise level exceeds 85 dBA**
  - X exposure duration small
  - X level is 48 dB

- **Other physical Agents**
  - Safe working area (absence of radiation, magnetic fields)
    - ✓ Earth
    - ✓ Earthed
    - ✓ Earth
    - ✓ Earth
    - ✓ Earth
    - ✓ Earth
    - ✓ Earth
    - ✓ Earth
    - ✓ Earth
    - ✓ Earth

- **Electrocution**
  - Strict procedure for de-energizing before working on electrical equipment
    - ✓ need repair
  - Proper fencing of S/S to prevent the public from electrocution
    - ✓ need repair
    - ✓ need repair
    - ✓ need repair

- **Electrocution**
  - ✓ need repair
  - ✓ need repair
  - ✓ need repair

- **Challenge**
  - Not measured
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- **Training of personnel for safety procedures**

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<td>Physical factors in the workplace</td>
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<td>Signage</td>
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<tr>
<td>Lighting (including security lights)</td>
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<tr>
<td>Fire detection mechanism/equipment</td>
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<td>Fire fighting equipment</td>
</tr>
<tr>
<td>Cleanliness (inside and outside S/S)</td>
</tr>
<tr>
<td>First Aid kit</td>
</tr>
<tr>
<td>Features that pose safety risks (missing or broken slabs, dogged holes, etc)</td>
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<tr>
<td>Fence or enclosure of the site (Restrictions of unauthorized people)</td>
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</table>

- **Welfare facilities**

| Safe and clean Drinking water            | ✓      | ✓      | ✓      | ✓      | ✓      | ✓ top | ✓      | X      | X      | X      |
| Toilets                                  | ✓      | ✓ repair | ✓ repair | X build | ✓      | ✓      | X const | X      | ✓ impr |
| TV/Radio                                 | ✓      | NA     | NA     | NA     | NA     | NA     | NA     | NA     | ✓      |
| Guard kiosk                              | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | ✓      | X build | X      |

- **Personal protective equipment**

<p>| Eye and face,                             | ✓      | ✓      | ✓      | Remote controlled (RC) | ✓      | RC from Ilala or Ubungo |
| Head                                     | ✓      | ✓      | ✓      | RC from Ilala or Ubungo |
| Hearing                                  | ✓      | ✓      | ✓      | RC from Ilala or Ubungo |
| Hand                                     | ✓      | ✓      | ✓      | RC from Ilala or Ubungo |
| Respiratory                              | ✓      | ✓      | ✓      | RC from Ilala or Ubungo |
| Leg and body                             | ✓      | ✓      | ✓      | RC from Ilala or Ubungo |</p>
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<td>None</td>
</tr>
<tr>
<td>Safety inspection, testing and calibration</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
</tr>
</tbody>
</table>
### Material handling (Hazardous and non-hazardous Materials)

<table>
<thead>
<tr>
<th>GUIDELINES CONSIDERED</th>
<th>ILALA</th>
<th>SOKOINE</th>
<th>CITY CENTRE</th>
<th>MIXOCHI NI</th>
<th>OYSTER BAY</th>
<th>FZONE III</th>
<th>FZONE II</th>
<th>FZONE I</th>
<th>KURASINE</th>
<th>Chelinda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>√</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>√</td>
<td>X</td>
<td>√</td>
<td>X</td>
<td>X</td>
<td>√</td>
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<tr>
<td>Labelling</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Handling</td>
<td>√ need</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>X imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
</tr>
</tbody>
</table>

### Solid wastes / scraps

<table>
<thead>
<tr>
<th>GUIDELINES CONSIDERED</th>
<th>ILALA</th>
<th>SOKOINE</th>
<th>CITY CENTRE</th>
<th>MIXOCHI NI</th>
<th>OYSTER BAY</th>
<th>FZONE III</th>
<th>FZONE II</th>
<th>FZONE I</th>
<th>KURASINE</th>
<th>Chelinda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
</tr>
<tr>
<td>Disposal</td>
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<td>√ imprv</td>
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<td>√ imprv</td>
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<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
<td>√ imprv</td>
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</table>

### Availability of Space for Expansion

<table>
<thead>
<tr>
<th>GUIDELINES CONSIDERED</th>
<th>ILALA</th>
<th>SOKOINE</th>
<th>CITY CENTRE</th>
<th>MIXOCHI NI</th>
<th>OYSTER BAY</th>
<th>FZONE III</th>
<th>FZONE II</th>
<th>FZONE I</th>
<th>KURASINE</th>
<th>Chelinda</th>
</tr>
</thead>
<tbody>
<tr>
<td>X require an extra land</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>X require an extra land</td>
<td>√</td>
</tr>
</tbody>
</table>

Environmental Audit is required: to identify environmental and safety shortcomings existing in substations and then corrective measures are recommended to improve the stations' environmental and safety performance to meet minimum WB guidelines requirements.

**Key**

- NA - Not Applicable
- ✓ - Yes or OK
- X - Not or No
- ✓ transf - yes on transformer
- ✓ OCB - yes on Oil Circuit Breaker
- ✓ AC - Air Conditioning
- ✓ imprv - It is there but needs some improvements
- Improv - Need some improvements
- RC - Remote controlled substation
- S/S - Substation
- Trng - Training
- Repair - need some repair
- Maint - maintenance is required
- Contain. - Yes, it is contaminated
APPENDIX 02: PHOTOGRAPHIC DOCUMENTATION
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

SUBSTATIONS: Photographic documentation

Photos 1: Mikocheni 33/11kV Substation

Photo doc. 1
Photos 2: Oyster Bay 33/11kV Substation

1

2

3
Photos 3: Msasani 33/11kV Substation
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photos 4: Ilala 132/33/11kV Substation

1

2

3

Photo doc.
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photo 5: City Centre 33/11kV Substation

Photo 6: Sokoine 33/11kV Substation

Photo 7: Factory Zone II 33/11kV Substation
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photo 8: Factory Zone III 132/33/11kV Substation

Photos 9: Factory Zone I 33/11kV Substation
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photos 11: Njiru 220/132/33kV Substation

Photo 12: Them 33/11kV Substation
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photos 13: Kilex 33/11kV Substation

Photos 14: Mount Meru 33/11kV Substation
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photos 15: Unga Limited 66/33/11kV Substation

1

2
Photos 16: Kiyungi 132/66/33kV Substation
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photos 17: Boma Mbuzi 33/11kV Substation

Photo doc. 12
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

Photos 18: Trade School 33/11kV Substation

1

2
Sample Number: 1

Date of Sample: 5/02/2004

Name of Region: [Illegible]

Name and designation of person who took the sample: S.W. McWandl Electric

Equipment Identification Number and Name: 02/78/905

Type of Equipment (See note below): Substation Transformer

Capacity of Equipment (kW or kVAR): 15,000kVA: 33:11:5

Equipment Installation Date (from nameplate if available): 1979

Name of Substation or Feeder: City Centre Substation

Note: Distribution Transformer, Substation Transformer, Capacitor Bank or Voltage Regulator
TEMPLATE TO BE FILLED FOR EVERY (OIL) SAMPLED EQUIPMENT

Sample Number: 1 - KINORTH
Date of Sample: 5/02/2004
Name of Region: KINORTH
Name and designation of person who took the sample: R.WIEGANYA (R918)/TECHNICIAN I
Equipment Identification Number and Name: T3142
Type of Equipment (See note below): SUBSTATION TRANSFORMER
Capacity of Equipment (kW or kVA): 5000 KVA: 33/11kV
Equipment Installation Date (from nameplate if available): 1963
Name of Substation or Feeder: OYSTERBAY SUBSTATION

Note: Distribution Transformer, Substation Transformer, Capacitor Bank or Voltage Regulator
TEMPLATE TO BE FILLED FOR EVERY (OIL) SAMPLED EQUIPMENT

Sample Number: 1

Date of Sample: 6/2/2004

Region: TEMPE

Person and designation of person who took the sample: W. Masanta, Elect. Technician

Equipment Identification Number and Name: 9248007

Type of Equipment (See note below): Substation Transformer

Capacity of Equipment (kW or kVA): 15000 kVA: 33 kV

Installation Date (from nameplate if available): 1993

Name of Substation or Feeder: Buguruni Substation (Factory Zone 1)

:: Distribution Transformer, Substation Transformer, Capacitor Bank or Voltage Regulator
TEMPLATE TO BE FILLED FOR EVERY (OIL) SAMPLED EQUIPMENT

Sample Number: 01 (T1)
Date of Sample: 5/3/2004
Name of Region: Aruba
Name and designation of person who took the sample: Fantine Anthony - W/Shop Eng.
Equipment Identification Number and Name: ____________________________
Type of Equipment (See note below): Substation Transformer
Capacity of Equipment (kW or kVA): 50
Equipment Installation Date (from nameplate if available): ____________________________
Name of Substation or Feeder: Aruba Power Station

Note: Distribution Transformer, Substation Transformer, Capacitor Bank or Voltage Regulator

-------------------------------

TEMPLATE TO BE FILLED FOR EVERY (OIL) SAMPLED EQUIPMENT

Sample Number: 02 (T3)
Date of Sample: 5/3/2004
Name of Region: Aruba
Name and designation of person who took the sample: Fantine Anthony - W/Shop Eng.
Equipment Identification Number and Name: ____________________________
Type of Equipment (See note below): Substation Transformer
Capacity of Equipment (kW or kVA): 1000
Equipment Installation Date (from nameplate if available): ____________________________
Name of Substation or Feeder: Aruba Power Station

Note: Distribution Transformer, Substation Transformer, Capacitor Bank or Voltage Regulator
## Report of Analysis

### Client Sample ID: t-ILALA
---

**Lab Sample ID:** T7312-1  
**Matrix:** SO - Oil  
**Method:** SW846 8082  
**Date Sampled:** 02/05/04  
**Date Received:** 04/16/04  
**Percent Solids:** n/a

### File ID
- **Run #1:** GG18352.D  
  **DF:** 1  
  **Prep Date:** 04/21/04  
  **Prep Batch:** OP3302  
  **Analytical Batch:** GGG555

---

### Initial Weight
- **Run #1:** 1.00 g  
- **Run #2:** 10.0 ml

### PCB List

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Compound</th>
<th>Result</th>
<th>RL</th>
<th>MDL</th>
<th>Units</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>12674-11-2</td>
<td>Aroclor 1016</td>
<td>ND</td>
<td>500</td>
<td>100</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11104-28-2</td>
<td>Aroclor 1221</td>
<td>ND</td>
<td>500</td>
<td>160</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11141-16-5</td>
<td>Aroclor 1232</td>
<td>ND</td>
<td>500</td>
<td>140</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>53469-21-9</td>
<td>Aroclor 1242</td>
<td>ND</td>
<td>500</td>
<td>120</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>12672-29-6</td>
<td>Aroclor 1248</td>
<td>ND</td>
<td>500</td>
<td>160</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11097-69-1</td>
<td>Aroclor 1254</td>
<td>ND</td>
<td>500</td>
<td>120</td>
<td>ug/kg</td>
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<tr>
<td>11096-82-5</td>
<td>Aroclor 1260</td>
<td>ND</td>
<td>500</td>
<td>100</td>
<td>ug/kg</td>
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<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Surrogate Recoveries</th>
<th>Run #1</th>
<th>Run #2</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>877-09-8</td>
<td>Tetrachloro-m-xylene</td>
<td>18% b</td>
<td>34-138%</td>
<td></td>
</tr>
<tr>
<td>2051-24-3</td>
<td>Decachlorobiphenyl</td>
<td>22%</td>
<td>20-182%</td>
<td></td>
</tr>
</tbody>
</table>

### Notes
- (a) Percent solids not analyzed due to sample matrix. Results reported on wet weight basis.
- (b) Outside control limits due to matrix interference.

**ND** = Not detected  
**MDL** - Method Detection Limit  
**RL** = Reporting Limit  
**J** = Indicates an estimated value  
**B** = Indicates analyte found in associated method blank  
**E** = Indicates value exceeds calibration range  
**N** = Indicates presumptive evidence of a compound
### Report of Analysis

**Client Sample ID:** 1-K/NORTH  
**Lab Sample ID:** T7312-6  
**Matrix:** SO - Oil  
**Method:** SW846 8082  
**Date Sampled:** 02/05/04  
**Date Received:** 04/16/04  
**Percent Solids:** n/a

### Project Information

<table>
<thead>
<tr>
<th>Run #1</th>
<th>File ID</th>
<th>DF</th>
<th>Analyzed By</th>
<th>Prep Date</th>
<th>Prep Batch</th>
<th>Analytical Batch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GG18357.D</td>
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<td>NS</td>
<td>04/21/04</td>
<td>OP3302</td>
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<tr>
<td>Run #2</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sample Details

- **Initial Weight:** 1.05 g  
- **Final Volume:** 10.0 ml

### PCB List

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Compound</th>
<th>Result</th>
<th>RL</th>
<th>MDL</th>
<th>Units</th>
<th>Q</th>
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</thead>
<tbody>
<tr>
<td>12674-11-2</td>
<td>Aroclor 1016</td>
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<td>480</td>
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<td>ug/kg</td>
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</tr>
<tr>
<td>11104-28-2</td>
<td>Aroclor 1221</td>
<td>ND</td>
<td>480</td>
<td>150</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11141-16-5</td>
<td>Aroclor 1232</td>
<td>ND</td>
<td>480</td>
<td>130</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>53469-21-9</td>
<td>Aroclor 1242</td>
<td>ND</td>
<td>480</td>
<td>110</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>12672-28-6</td>
<td>Aroclor 1248</td>
<td>ND</td>
<td>480</td>
<td>150</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11087-69-1</td>
<td>Aroclor 1254</td>
<td>ND</td>
<td>480</td>
<td>110</td>
<td>ug/kg</td>
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<td>11086-82-5</td>
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</table>

- **CAS No.** Surrogate Recoveries  
  - Run #1  
  - Run #2  
  - Limits

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Compound</th>
<th>Result</th>
<th>Run #1</th>
<th>Run #2</th>
<th>Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>877-09-8</td>
<td>Tetrachloro-m-xylene</td>
<td>46%</td>
<td></td>
<td></td>
<td>34-138%</td>
</tr>
<tr>
<td>2051-24-3</td>
<td>Decachlorobiphenyl</td>
<td>17%</td>
<td></td>
<td></td>
<td>20-162%</td>
</tr>
</tbody>
</table>

(a) Percent solids not analyzed due to sample matrix. Results reported on wet weight basis.  
(b) Sample appears to contain PCB congeners that do not match any of the standard PCB patterns.  
(c) Outside control limits due to matrix interference.

**ND = Not detected**  
**MDL = Method Detection Limit**  
**J = Indicates an estimated value**  
**RL = Reporting Limit**  
**B = Indicates analyte found in associated method blank**  
**E = Indicates value exceeds calibration range**  
**N = Indicates presumptive evidence of a compound**
**Report of Analysis**

<table>
<thead>
<tr>
<th>Client Sample ID:</th>
<th>01 (TI)-ARUSH</th>
<th>Lab Sample ID:</th>
<th>T7311-9</th>
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</thead>
<tbody>
<tr>
<td>Matrix:</td>
<td>SO - OIl</td>
<td>Date Sampled:</td>
<td>03/05/04</td>
</tr>
<tr>
<td>Method:</td>
<td>SW846 8082</td>
<td>Date Received:</td>
<td>04/16/04</td>
</tr>
<tr>
<td>Project:</td>
<td>Tanesco - Tan, SW846 3580A</td>
<td>Percent Solids:</td>
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</table>

**PCB List**

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<thead>
<tr>
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<th>Compound</th>
<th>Result</th>
<th>RL</th>
<th>MDL</th>
<th>Units</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>12674-11-2</td>
<td>Aroclor 1016</td>
<td>ND</td>
<td>470</td>
<td>94</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11104-28-2</td>
<td>Aroclor 1221</td>
<td>ND</td>
<td>470</td>
<td>150</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11141-16-5</td>
<td>Aroclor 1232</td>
<td>ND</td>
<td>470</td>
<td>130</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>53469-21-9</td>
<td>Aroclor 1242</td>
<td>ND</td>
<td>470</td>
<td>110</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>12672-29-6</td>
<td>Aroclor 1248</td>
<td>ND</td>
<td>470</td>
<td>110</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11097-69-1</td>
<td>Aroclor 1254</td>
<td>ND</td>
<td>470</td>
<td>110</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11096-82-5</td>
<td>Aroclor 1268</td>
<td>ND</td>
<td>470</td>
<td>94</td>
<td>ug/kg</td>
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</table>

**Surrogate Recoveries**

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Compound</th>
<th>Run# 1</th>
<th>Run# 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>877-09-8</td>
<td>Tetrachloro-m-xylene</td>
<td>30% c</td>
<td>34-138%</td>
</tr>
<tr>
<td>2051-24-3</td>
<td>2,4,6-trichloro-phenol</td>
<td>29%</td>
<td>20-162%</td>
</tr>
</tbody>
</table>

(a) Percent solids not analyzed due to sample matrix. Results reported on wet weight basis.

(b) Sample appears to contain PCB congeners that do not match any of the standard PCB patterns.

(c) Outside control limits due to matrix interference.

---

**Legend:**

- ND = Not detected
- MDL = Method Detection Limit
- RL = Reporting Limit
- J = Indicates an estimated value
- B = Indicates analyte found in associated method
- N = Indicates presumptive evidence of a compound

---

**Batches and Analytical Batch:**

- C18432 D
- Date: 04/24/04
- Batch: G.C.C.S.6
Accutest Laboratories

Report of Analysis

<table>
<thead>
<tr>
<th>File ID</th>
<th>DF</th>
<th>Analyzed By</th>
<th>Prep Date</th>
<th>Prep Batch</th>
<th>Analytical Batch</th>
</tr>
</thead>
<tbody>
<tr>
<td>GG18480.D</td>
<td>1</td>
<td>04/26/04</td>
<td>NS</td>
<td>04/22/04</td>
<td>OP3368 GGG556</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Run #</th>
<th>Initial Weight</th>
<th>Final Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>1.01 g</td>
<td>10.0 ml</td>
</tr>
<tr>
<td>#2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### PCB List

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Compound</th>
<th>Result</th>
<th>RL</th>
<th>MDL</th>
<th>Units</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>12674-11-2</td>
<td>Aroclor 1016</td>
<td>ND</td>
<td>500</td>
<td>99</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11104-28-2</td>
<td>Aroclor 1221</td>
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<td>500</td>
<td>160</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11141-15-5</td>
<td>Aroclor 1232</td>
<td>ND</td>
<td>500</td>
<td>140</td>
<td>ug/kg</td>
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</tr>
<tr>
<td>53469-21-9</td>
<td>Aroclor 1242</td>
<td>ND</td>
<td>500</td>
<td>120</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>12672-28-6</td>
<td>Aroclor 1248</td>
<td>ND</td>
<td>500</td>
<td>160</td>
<td>ug/kg</td>
<td></td>
</tr>
<tr>
<td>11097-89-1</td>
<td>Aroclor 1254</td>
<td>ND</td>
<td>500</td>
<td>140</td>
<td>ug/kg</td>
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</tr>
<tr>
<td>11098-82-5</td>
<td>Aroclor 1260</td>
<td>ND</td>
<td>500</td>
<td>99</td>
<td>ug/kg</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAS No.</th>
<th>Surrogate Recoveries</th>
<th>Run #</th>
<th>Run #</th>
<th>Limits</th>
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<tbody>
<tr>
<td>877-09-8</td>
<td>Tetrachloro-xylene</td>
<td>30%</td>
<td>34-138%</td>
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<tr>
<td>2051-24-3</td>
<td>Decachlorobiphenyl</td>
<td>20%</td>
<td>20-162%</td>
<td></td>
</tr>
</tbody>
</table>

(a) Percent solids not analyzed due to sample matrix. Results reported on wet weight basis.
(b) PCB pattern appears to be weathered.
(c) Outside control limits due to matrix interference.

ND = Not detected  MDL = Method Detection Limit  J = Indicates an estimated value
RL = Reporting Limit  B = Indicates analyte found in associated method blank.
E = Indicates value exceeds calibration range  N = Indicates presumptive evidence of a compound
## Sample Summary

**Stone & Webster Consultants**

Tanesco - Tanzania  
Project No: Tanesco-Tanzania Super Region 1  

<table>
<thead>
<tr>
<th>Sample Number</th>
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<th>Received Date</th>
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<th>Type</th>
<th>Client Sample ID</th>
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<tr>
<td>T7312-1</td>
<td>02/05/04</td>
<td>00:00</td>
<td>04/16/04</td>
<td>SO</td>
<td>Oil</td>
<td>1-ILALA</td>
</tr>
<tr>
<td>T7312-2</td>
<td>02/05/04</td>
<td>00:00</td>
<td>04/16/04</td>
<td>SO</td>
<td>Oil</td>
<td>2-ILALA</td>
</tr>
<tr>
<td>T7312-3</td>
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<td>04/16/04</td>
<td>SO</td>
<td>Oil</td>
<td>3-ILALA</td>
</tr>
<tr>
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</tr>
<tr>
<td>T7312-5</td>
<td>02/05/04</td>
<td>00:00</td>
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</tr>
<tr>
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<td>04/16/04</td>
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<td>Oil</td>
<td>1-K/NORTH</td>
</tr>
<tr>
<td>T7312-7</td>
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<td>2-K/NORTH</td>
</tr>
<tr>
<td>T7312-8</td>
<td>02/05/04</td>
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<td>3-K/NORTH</td>
</tr>
<tr>
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<td>4-K/NORTH</td>
</tr>
<tr>
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<tr>
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<td>T7312-12</td>
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<td>T7312-13</td>
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<td>3-K/SOUTH</td>
</tr>
</tbody>
</table>

Soil samples reported on a dry weight basis unless otherwise indicated on result page.
# Sample Summary

(continued)

**Stone & Webster Consultants**  
**Job No:** T7312  
**Project No:** Tanesco-Tanzania Super Region 1

<table>
<thead>
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<td>T7312-19</td>
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<td>T7312-20</td>
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<td>SO Oil</td>
<td>5-TEMEKE</td>
</tr>
</tbody>
</table>

Soil samples reported on a dry weight basis unless otherwise indicated on result page.
**Sample Summary**

**Stone & Webster Consultants**  
Job No: T7311

**Tanesco - Tanzania**  
Project No: Tanesco-Tanzania Super Region 2

<table>
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<td>SO Oil</td>
<td>TANGA-1</td>
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<tr>
<td>T7311-2</td>
<td>03/10/04</td>
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<td>04/16/04</td>
<td>SO Oil</td>
<td>01-HALE-TANGA REGION</td>
<td></td>
</tr>
<tr>
<td>T7311-3</td>
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<td>04/16/04</td>
<td>SO Oil</td>
<td>2-HALE-TANGA REGION</td>
<td></td>
</tr>
<tr>
<td>T7311-4</td>
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</tr>
<tr>
<td>T7311-5</td>
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<td>02-KILI</td>
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</tr>
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<td>03-KILI</td>
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</tr>
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<td>T7311-7</td>
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<td>MOSHI 4 (KILI)</td>
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</tr>
<tr>
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<td>04/16/04</td>
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<td>01-NYM KILIMANJARO</td>
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<tr>
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<td>04/16/04</td>
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</tr>
<tr>
<td>T7311-10</td>
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<td>02 (T3)-ARUSHA</td>
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</tr>
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<td>T7311-11</td>
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<td>00:00</td>
<td>04/16/04</td>
<td>SO Oil</td>
<td>ARUSHA-4</td>
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</tr>
</tbody>
</table>

Soil samples reported on a dry weight basis unless otherwise indicated on result page.
APPENDIX 04: LIST OF CONSULTED PEOPLE
LIST OF PEOPLE CONSULTED

TANESCO LTD
1. Mr. Masasi TANESCO Regional Manager, Arusha
2. Mr. N. Nsulau TANESCO Regional Manager, Kilimanjaro
3. Mr. Desder R. Rutta Substations Technician Supervisor (Arusha)
4. Mr. Faustine Mavelle Substations Maintenance Engineer (Kilimanjaro, Arusha and Tanga)
5. Mr. Said Msemo Electrical Technician (Ilala)
6. Ms. R. Luteganya Electrical Technician (Kinondoni North)
7. Mr. Ngonyani Substations Engineer (Kilimanjaro)
8. Mr. James Luchagula Investigations Engineer (DCPR –TANESCO HQ)
9. Mr. Gadiye Substation Maintenance Engineer (Electrical Workshop – Ubungo)
10. Mr. Pascal C. Mwoga System Control Supervisor (Factory Zone III)
11. Mr. Eli Mbuya Control Room Technician (Njiro substation)
12. Mr. Rahim Mziray Control Room attendant (Unga Limited substation)
13. Mr. John Shadow Control Room Technician (Kiyungi)
14. Mr. Muki Control Room Technician (Kiyungi)

OTHER INSTITUTIONS
15. Mr. Charles Swai Vice President’s Office – Division of Environment (DOE)
16. Mrs. Kisanga Vice President’s Office – DOE
17. Ms. A Madete Assistant Director DOE - Vice President’s Office
18. Mr. J. R. Kombe Assistant Director EIA – NEMC
19. Mr. Edward Kihunrwa Ministry of Land and Human Settlement- TRC member
20. Mr. Julius Shilungushela Land Use Commission MLHS – TRC member
21. Ms. Agness Mwakaje Institute of Resource Assessment UDSM – TRC Member
22. Mr. Jeko Sanga Resident near Msasani Substation
23. Ms. Jawa Elias Kisapile Security guard Factory Zone II substation
24. Mr. G. K. Mkeni Ward Executive Secretary Engutoto - Njiro

NJIRO - ENGUTOTO WARD RESIDENTS - MEETING HELD ON 25TH NOVEMBER 2004

Agenda:
➢ Public information about the project i.e. the construction of new transmission line from Kiyungi to Njiro Substation and rehabilitation of the Njiro Substation
➢ Receiving comments and concerns about the proposed project from people along the new proposed line and around the substation

LIST OF MEETING PARTICIPANTS

1. Lobulu Siroeti
2. Abdul Majid Ahmed
3. Innocent Zelotho C/O Makundi Boaz
4. Elisipha Loth
5. Monika Kisiri
6. E. A. Mollie
7. Elisha Philipo
8. Paul Kamete
9. Philipo Memruthi
10. Jacksoni John
11. Hermony Richard
12. Khalid Issa Mohamed
13. Zainabu Sindato
14. Petro Kamete
15. Lawrence Memruthi
16. Lengai Namuriri
17. Japhet Silas
18. Lubanguti Long’amu
19. Felex Saimkwa
20. Marko Simon
21. Stephano Merinyo
22. James Memruthi
23. Obadia Kisiri
24. Abdallah Ismail
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Title/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>Erasto Meleji</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>John Abrahamu</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Michael Memruthi</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Bernard Memruthi</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Edward Sikon</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Joseph Memruthi</td>
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</tr>
<tr>
<td>31</td>
<td>Meshack Shangai</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Mohamed Abrahaman</td>
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<td>33</td>
<td>Ezekiel Shangai</td>
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<td>34</td>
<td>Elias Memruthi</td>
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<td>35</td>
<td>Estomii Meseya</td>
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<td>36</td>
<td>Magnet Stephen</td>
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<td>37</td>
<td>Mrs Lukenelo R. Mbagu</td>
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<tr>
<td>38</td>
<td>Philipo Eliapenda</td>
<td></td>
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<td>39</td>
<td>Coelestina Kazaura</td>
<td></td>
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<tr>
<td>40</td>
<td>Ramadhani Ibrahim Lesian</td>
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<td>41</td>
<td>Stephen George Mollie (Councillor)</td>
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<tr>
<td>42</td>
<td>Lothi S. Kola (Chairperson Hamlet C1)</td>
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<td>Elizabeth Mtwara (Chairperson Hamlet C2)</td>
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<td>George K. Mkeni (WEO- Engutoto)</td>
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<td>45</td>
<td>John Lazimah – Env. Engineer TANESCO HQ</td>
<td></td>
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<tr>
<td>46</td>
<td>Mansur Hamduni – Env. Engineer TANESCO HQ</td>
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<td>47</td>
<td>Dr. Agnes Mwakeme – IRA UDSM - TRC Member</td>
<td></td>
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<tr>
<td>48</td>
<td>Mr. Julius Shilungushela – MLHS – TRC Member</td>
<td></td>
</tr>
<tr>
<td>49</td>
<td>Mr. Edward Kihurwa – MLHS – TRC Member</td>
<td></td>
</tr>
</tbody>
</table>

MCHIKICHINI RESIDENTS - MEETING HELD ON 19th January 2005

Agenda:
- Public information about the project i.e. construction of new transmission line from Ilala Substation to Kurasini Substation and rehabilitation of Ilala Substation
- Receiving comments and concerns about the proposed project from people along the new proposed line and around the substation

LIST OF MEETING PARTICIPANTS

1. Khatibu Riyami – VC
2. Rajabu Zegega – Asst. VC
3. Jumanne Kibona
4. Rajabu Mdodo
5. Abdulkadiri Kagandi
6. Thabit Kadulo
7. Kawasa Kasanda
8. Selemann Normohid
9. Kondo Mohamed
10. Hamis Kaganja
11. Almasi Semlengwa
12. Rashid Ally
13. Doto Ally
14. Venance Tarimo
15. Idd Kitingo
16. Hasan Salum
17. Ramadhani Rashid
18. Ramadhani Fimba
19. David Sempira
20. Caroline Joseph
21. Maua Rashid
22. Valeriano
23. Omary Kishimba
24. Johari Mkonganya
25. Stumai Omary
26. Ally Magoga
27. Jumanne Kadulo
28. Likulile Musa
29. Shaban Kondo
30. Hadija Omari
31. Zuena Kasamba
32. Teresia Robart
33. Habibu Kika
34. Shaban Adam
35. Kulwa Kalenga
36. Moshi Omari
37. Juma Magoga
38. Rehema Maulid
39. Joseph Simbaultanga
40. Fatuma Hajaji
41. Mwanahamis Athuman
42. Hamis Daud
43. Tabita Athuman
44. Said Walala
45. Masangura Joshua
46. Amina Mung
47. Arubugast Peter
48. Rashid Mgeni
49. Fatuma Hassan
50. Fasi Pius
51. Zuhura Fadhili
52. Hamisa Chaad
53. Rajabu Omari
54. Arina Shaban
APPENDIX 05: Training Needs
ENVIRONMENTAL UNIT TRAINING NEEDS UNDER THE WORLD BANK PROJECT

ENVIRONMENTAL MANAGEMENT HEALTH AND SAFETY

AN OVERVIEW PLAN AND BUDGET
FINANCIAL YEAR 2005 - 2006

1.0 General information
It is proposed that some amount of money earmarked for the project should be used for capacity building purposes. The training should be focused in environmental, health and safety management. The purpose of the training should be to strengthen TANESCO's environmental health and safety management performance in the audited substations and strengthening the capability of environmental unit to carry out environmental audits, EIA and monitoring studies. This will also ensure that environment is given appropriate consideration in all substation operations, and development.

It is proposed that the environmental unit participate in the courses organized by the East and Southern African Management Institute (ESAMI) in the area of environmental audit and environmental management. The substations personnel should attend a tailor made courses that will focus on the environment, health and safety and work procedures using reputable resource persons.

2.0 Implementation Plan
In the year 2005/2006 financial year, the following should be done:
✓ Capacity building through training (short term environmental courses) of Environmental Unit staff
✓ In house seminars for capacity building on Environmental, Health and Safety awareness raising and work procedures to all TANESCO staff working in the substations (operating and maintenance technicians and engineers)

3.0 The courses and the estimated costs
The estimated implementing costs are shown in the table below:

<table>
<thead>
<tr>
<th>S/N</th>
<th>Proposed course/ training</th>
<th>Number of Participants</th>
<th>Course Dates</th>
<th>Anticipated costs (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Environmental Management (Windhoek Namibia) ESAMI programme</td>
<td>1</td>
<td>(4 weeks) 2005/6</td>
<td>9,400</td>
</tr>
<tr>
<td>2</td>
<td>Environmental Audit Programme (Harare) ESAMI Programme</td>
<td>2</td>
<td>(4 weeks) 2005/6</td>
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</tbody>
</table>
4.0 Equipment and tools
Materials and equipment requirements for smooth implementation of the proposed Environmental Monitoring Program (EMP) and audits are as follows.

<table>
<thead>
<tr>
<th>S/N</th>
<th>Equipment/Tool</th>
<th>Nos.</th>
<th>Costs (USD)</th>
</tr>
</thead>
<tbody>
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</tr>
<tr>
<td>2</td>
<td>Colour Laser Printer</td>
<td>1</td>
<td>2,500</td>
</tr>
<tr>
<td>3</td>
<td>Digital camera</td>
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<td>1,600</td>
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<tr>
<td></td>
<td>TOTAL</td>
<td></td>
<td>8,100</td>
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</table>

The total amount required for the year 2005/2006 is USD 69,300.
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System

APPENDIX 06: Environmental Management System (EMS) Project Document
TANZANIA ELECTRIC SUPPLY COMPANY LIMITED

PROPOSAL FOR DEVELOPING AND IMPLEMENTING ENVIRONMENTAL MANAGEMENT SYSTEM (EMS) IN TANESCO

DRAFT PROJECT DOCUMENT

DIRECTORATE OF CORPORATE PLANNING AND RESEARCH
DEPT OF RESEARCH & DEVELOPMENT
ENVIRONMENTAL UNIT
May 2005
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<th>Page</th>
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<tr>
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<td>3.0 PROJECT ACTIVITIES, RESULTS AND MAIN ASSUMPTIONS</td>
<td>ix</td>
</tr>
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<td>3.2 PROJECT RESULTS</td>
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<td>4.0 WORK PLAN AND METHODOLOGY</td>
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<td>4.1 GENERAL APPROACH</td>
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<tr>
<td>4.2 DRAFTING OF CORPORATE ENVIRONMENTAL POLICY</td>
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<td>4.3 PLANNING FOR FULFILLING THE COMPANY POLICY</td>
<td>xi</td>
</tr>
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ACRONYMS

DoE  Department of Environment
EAMRDC  East Africa Mineral Resources Development Centre
EIA  Environmental Impact Assessment
EMS  Environmental Management System
ESC  Environmental subcommittee of the Southern African Power Pool (SAPP)
WB  World Bank
ICH  International Centre for Hydropower
ISO  International Standards Organisation
NEMC  National Environmental management Council
NEP  National Environmental policy
NGO  Non Governmental Organisation
PFRP  Pangani Falls Redevelopment Project
SAPP  Southern Africa Power Pool
TANESCO  Tanzania Electric Supply Company Limited
UDSM  University of Dar es Salaam
ZESCO  Zambia Electricity Supply Company
EXECUTIVE SUMMARY

ES1: Introduction
TANESCO is a public power utility in Tanzania responsible for generation, transmission, distribution and sale of electricity. Due to the nature of TANESCO's activities, there are always impacts on or from the environment, which need to be considered during operation and development decision-making processes.

There has been growing concern both nationally and internationally for full incorporation of environmental protection in decision-making processes for economic activities. The approved National Environmental policy (NEP) and passed of the Environmental Management Act, 2005 (It is unified environmental legislation to deal with the environmental issues). This Act is expected to become effective any time in 2005. All these require every developer to achieve sustainable development that maximises the long-term welfare of both the present and future generations of Tanzanian population.

In order to comply with relevant legal and regulatory requirements, TANESCO is in process of establishing its own Environment Management System (EMS). The EMS will ensure that environment is given appropriate consideration in all company development activities and decision-making processes.

ES2: Objectives
The following are the main project objectives:

- To develop an appropriate corporate environmental policy, objectives and targets
- To develop a system that will ensure that there is full integration of environmental considerations in all TANESCO's work and decision-making processes.
- To establish a system that will ensure continual improvement of the environmental management in TANESCO.
- To demonstrate to public that TANESCO is protecting the environment in carrying out its activities.

Financing
It is proposed that part of the funds to be provided by The World Bank to finance the Transmission and Distribution Rehabilitation project (Dar es Salaam, Kilimanjaro and Arusha) is to be used also to finance a process of establishing the EMS in Tanzania Electric Supply Company Ltd (TANESCO).
ES4: Budget
The total project budget is Five hundred and Nine thousands six hundred and twenty eight United State Dallas (US$ 509,628) spread over a span of 5 years. It is anticipated that about US$ 257,520 will be utilised in phase I (first two years) and US$ 227,840 in phase II (the last three years). A contingency of US$24,268 has been included in the budget to cater for unforeseen expenditure and escalation.

ES5: Duration
Five (5) years Phase I- drafting of company environmental policy. Phase II Implementation of the environmental policy

ES5: Implementers
The project will be coordinated and executed by the TANESCO'S Research and Development Department under Environmental Section with assistance of Division of Environment (DoE) and National Environmental Management Council (NEMC)) and individuals outside TANESCO will be fully utilised in conducting meetings, seminars and education campaign to TANESCO employees, local and foreign environmental consultants where necessary. The Environmental Section, which is under the Directorate of Corporate Planning and Research, has both capability and experience to carry out the work.

ES6: Project Results
The following are the expected main project results:
- Approved company environmental policy
- Environmental awareness to employees to understand the environmental implications of their actions
- Changed organisational culture and attitude towards environmental decision making processes.
- An improved environmental accountability
- An effective environmental information management system
- An effective and evolving EMS covering all aspects of TANESCO business, products and services
1.0 INTRODUCTION

1.1 GENERAL

The worldwide evolutions of stringent environmental regulations and public awareness have forced many organisations to integrate environmental management into their development activities and decision-making processes. Companies have introduced environmental management policies, which encourage preventive measures in order to minimise corrective environmental costs, loss of public image and penalties.

Achieving sound environmental performance requires organisational commitment to a systematic approach of addressing environmental obligations through Environmental Management system (EMS). Environmental Management System (EMS) is defined as a system which includes organisational structure, planning of activities, responsibilities, practices, procedures, processes and resources allocation for developing, implementing, achieving, reviewing and maintaining the environmental policy.

An environmental management system forms a framework within which to organise and plan activities required to achieve environmental goals and objectives of the company. It comprises guiding principles, policies, and directives, operational guidelines and procedures that provide a structured format by which operations can be maintained. It is internationally accepted as a common sense approach to ensure that organisational environmental liabilities (and risks) are properly identified, minimised and managed.

TANESCO is a public utility, the only main company so far in Tanzania responsible for generation, transmission, distribution and sale of electricity. The company owns and operates power systems comprising of both hydro and thermal power stations and associated structures such as transmission & distribution lines, substations etc. The power system network is distributed throughout the country and continues to expand to meet ever-growing power demand. In the future, because of technological advancement and increase in demand, TANESCO may resort to other sources of energy such as coal, wind, solar etc.

Due to the nature of its operation and development activities, there are impacts on and from the environment, which have to be taken into account at all stages of such works. Apart from generation, transmission and distribution, TANESCO interacts with the environment through non-core services such as transportation of equipment and materials, fumes, disposing of old equipment and papers etc. In doing its development

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1 ISO 14004: Environmental Management Systems-general guidelines on principles, systems and supporting techniques.
and operational obligations, TANESCO may therefore cause environmental impacts to air, water, land, natural resources, flora, fauna, humans and ecosystem. Annex I, shows the linkage between TANESCO activities and environmental impacts.

TANESCO, like any other developer is obliged to adhere to the principles of sustainable development by ensuring that environmental issues are not outweighed by economic pressures. For that matter TANESCO has been spending substantial resources on EIAs and monitoring of the projects impacts on or from the environment.

There are several set backs to the present TANESCO approach of addressing the environmental issues. Currently TANESCO has no established system for dealing with environmental matters within the company. Furthermore, the company has neither environmental policy nor environmental objectives. More usually, environmental considerations are integrated in donor-funded projects, mainly in the planning and construction phase. Unless there is a direct environmental problem hindering power generation or there is a donor support, TANESCO does not bother much about post construction phase environmental problems.

As a remedy to the above set backs, TANESCO is in process of establishing an Environmental Management System (EMS). The EMS will form a framework through which all environment matters will be fairly addressed and integrated in all company business, services and products.

In the Southern Africa Power Pool (SAPP), of which TANESCO is a member, the Environmental subcommittee (ESC) has been formed to advise the management committee on environmental issues, keep abreast of regional and world issues related to environmental quality and also liaise with their respective governments on matters pertaining to environment. Some utilities in the region such as ESKOM of South Africa and ZESCO of Zambia already have their own Environmental Management System to take care of the environmental matters and are in good position to cope well with the new developments. The Environmental subcommittee (ESC) of the Southern African Power Pool (SAPP) has conducted environmental workshops with the aim of improving environmental awareness among the regional power utilities. TANESCO as an active member in the Southern African Power Pool (SAPP) has to keep pace with other regional utilities by developing and implementing EMS.

1.2 PREVIOUS WORK

TANESCO recognised the importance of integrating of environmental considerations in its activities in 1996 when it formally accepted a proposal for an ENVIRONMENTAL MANAGEMENT SYSTEM prepared by the consultants for the PFRP, IVO-NORPLAN. In April 1996, TANESCO in collaboration with NEMC organised a workshop on "ENVIRONMENTAL MATTERS RELATED TO POWER PRODUCTION IN TANZANIA" at Hale. At this workshop the then proposed TANESCO Environmental Management System (EMS) was discussed and its implementation recommended.
TANESCO's Field Studies Unit by then now the Research and Development Department in cooperation with IVO INTERNATIONAL of Finland prepared a detailed project document entitled: DEVELOPMENT OF ENVIRONMENTAL MANAGEMENT SYSTEM FOR TANESCO in 1997 - 99, for soliciting of funds for implementation of EMS. The project never started, because 1996 was a bad financial year for TANESCO and FINNIDA did not approve the requested fund.

Since then TANESCO tried to solicit funds from different donors and internally but up to date no substantial amount of fund is provided. In 2001 during the Kihansi Spray Toad saga the Lower Kihansi Environmental Project (LKEMP) financed by World Bank set aside US$ 65,000 to help TANESCO in the process of establishing its own EMS. So far a study tour to ESKOM and ZESCO for 5 staff 1 from Kihansi Power Plant and 4 from Directorate of Corporate Planning and Research has been done, with main objective of gaining a knowledge and experience on establishing and implementing an EMS in power utilities.

This proposal therefore include foreign assistance, be it finance or technical. It is proposed that financing is to be covered by the World Bank through proposed Transmission and Distribution Rehabilitation Project and the technical part will be carried out by TANESCO staff in collaboration with local and foreign environmental consultants as far as necessary. SAPP member utilities that have EMS may be visited and consulted for advice.

2.0 PROJECT PURPOSES AND OBJECTIVES

2.1 PROJECT PURPOSE

The main purposes of this work are:
- To prepare the company environmental policy and set objectives and targets
- To establish a system within TANESCO that will ensure planning, implementation, reviewing and continual improvement (i.e. EMS).

2.2 PROJECT OBJECTIVES

The main objectives of this work are:
- To establish a system that will ensure continual improvement of the environmental management in TANESCO.
- To develop and establish an effective EMS within TANESCO
- To ensure that there is full integration of environmental considerations in all work processes, planning and execution of all TANESCO activities.
- To demonstrate to public that TANESCO is protecting the environment in carrying out its activities.
3.0 PROJECT ACTIVITIES, RESULTS AND MAIN ASSUMPTIONS

3.1 PROJECT ACTIVITIES

The following are the main project activities:

PHASE I

- Review of the existing environmental management practices in TANESCO, legislative and regulatory requirements
- Review of the interaction of TANESCO activities and environment and identification of significant environmental effects
- Drafting of Corporate Environmental Policy
- Setting Objectives and targets, consistent with the environmental policy, which quantify the commitment to continual improvement in environmental performance over defined timescales
- Definition of responsibilities to ensure that control, verification, measurement and testing within the company & parts of the company are adequately coordinated and effectively performed.

PHASE II

- Carrying out environmental awareness meetings and seminars
- Developing procedures for monitoring and auditing to be carried out
- Developing a system of records control to demonstrate compliance with the requirements of the environmental management system
- Developing procedures to communicate with interested parties on matters relating to TANESCO’S environmental management, policy and performance.
- Facilitate planning, control, monitoring, auditing and review activities to ensure that the policy is complied with and that it remains relevant and capable of evolution to suit changing circumstances.
- Initiate implementation of EMS

3.2 PROJECT RESULTS

The following are the expected results of the work:

- Approved company environmental policy and clear objectives and targets
- Environmental awareness to employees to understand the environmental implications of their actions and have skills to make the right decisions
- An effective and evolving EMS covering all aspects of TANESCO business, products and services
- Environmental Management implementation structure and programs
- Changed organisational culture and attitude towards environmental decision-making processes.
- An improved environmental accountability
An effective system of planning, monitoring, auditing and reviewing of environmental activities
An effective system of preventing non compliance
An effective environmental information management system
Appointed staff who is capable of dealing with environmental matters

3.3 ASSUMPTIONS
For smooth execution of this work and achieving the intended results, the following assumptions have been made:

- The work will continue to enjoy full support from TANESCO top Management
- Appointed and/or recruited staff will be capable and interested in this important field
- World Bank to finance the establishment of EMS
- Research and Development Department under Environmental Unit to co-ordinate and execute this work

4.0 WORK PLAN AND METHODOLOGY

4.1 GENERAL APPROACH
In recent years, several organisations have developed, or are developing, guidelines for EMS. These include the British Standards Institute, Canadian Standards Association, European Community ("Euro-Audit"), the Canadian Chemical Producers Association (Responsible Care Program), the Canadian Petroleum Association (Environmental Code of Practice) and the International Standards Association (ISO). International Standards Organisation (ISO) has developed a series of environmental management system standards, which have been adopted by more than 100 countries worldwide as national standards and have proved to be successful.

In establishing and implementing TANESCO EMS, recommendation contained in the ISO 14000 series will be followed, i.e. preparatory review, drafting of policy and implementing the policy. Phase I of this work will consist of all activities for establishing the EMS i.e. preparatory review, drafting of the policy and planning for fulfilling the policy. Phase II will be an implementation phase in which all planned activities will be executed.

4.2 DRAFTING OF CORPORATE ENVIRONMENTAL POLICY
Because TANESCO does not have a formal environmental management system, the first step will be to establish the current position with regard to the environmental
management by means of a preparatory review. The preparatory review will identify the environmental aspects arising from the organisation's past, existing or planned activities, products or services. It will also examine all existing environmental management practices and procedures, legal requirements and previous incidents and non-compliance. The review will establish the main impacts due to TANESCO activities and the current means of dealing with them. This will form a base for identifying the priorities to be addressed in the environmental policy. Few field trips to generating stations, transmission and distribution lines, on going projects etc. will be made to confirm results of the review and to collect additional reports and information.

This work will involve drafting of an appropriate corporate environmental policy that is current and consistent with overall corporate priorities, management philosophy, practices and environmental legal requirements and obligations. It will involve utilising results from the preparatory review and current guiding principle for implementation of EMS. Since formulation of the corporate policy is the heart of the whole exercise, the three months time will be allocated to the management to read and comment on the draft environmental policy. The final policy statement and management commitment statement are expected to be ready in three months time after receiving comments from management.

Environmental Unit will do the preparatory review of drafting of corporate environmental policy in collaboration with local or foreign consultant. Consultation with other stakeholder's i.e. government environmental bodies, NGO's, affected peoples on some issues might be necessary.

4.3 PLANNING FOR FULFILLING THE COMPANY POLICY

For fulfilling the environmental policy, appropriate corporate environmental objectives and targets will be established and environmental programs (environmental quality control, monitoring and auditing etc.) documents prepared. The ways of integrating environment management into the company structure will be charted out and responsibility clearly defined. Approval of the management is required at this stage to make sure that the proposal is acceptable and is not in any way conflicting company structure expansion plan.

Parallel to preparation of the environmental programmes, training needs programs; schedules and budget will be established. It is expected that the training will target three groups; the management, Research and Development (Environmental Unit) and general staff, each category receiving training according to the role each group plays in the implementation of EMS.

Another important task to be accomplished in this phase is preparation of the environmental management system documentation, communication and records control systems. A two-way interactive information flow and reporting system, which involve
input from each and every staff at his working station meanwhile allowing appropriate data collection and analysis, interpretation and decision-making, will be chattered out.

For smooth implementation of the EMS, the training of management and key research and development staff in environmental management will start in this phase and extended through the implementation phase is important. Details on the training requirements are presented in section 5.

A final draft EMS report will be submitted to the management for approval at the end of this phase. The draft report shall contain the corporate environmental policy, objectives, targets, budget and schedule for implementation.

Planning and drafting of the environmental programmes will require inputs from different experts. It is therefore expected that in this phase external expertise, mainly from UDSM, NEMC, DoE and appropriate NGOs will be required. The programmes need to be discussed in the workshops and comments incorporated prior to their adoption.

4.4 IMPLEMENTATION OF EMS

The implementation of the EMS will consist of all activities that will facilitate integration of environmental policies and programmes into TANESCO strategic plans, practices and activities. The objective of this phase will be to align TANESCO structure, employees, systems, strategies and resources allocation towards achievement of company environmental objectives. The main activities to be carried out under this phase are:

- Training, educating and motivating employees to conduct their activities in an environmentally friendly manner and aiming at achieving company environmental objectives, goals and targets. This will involve conducting environmental meetings and seminars for disseminating education and awareness to TANESCO personnel in the head office and in the operation regions and districts, all hydro and thermal systems and transmission line teams around the country.

- Follow up of allocation of appropriate human, material (facilities and equipment) and financial resources essential to the implementation of company environmental policy and achievement of objectives.

- Follow up of integration of EMS into existing overall management system and practices, e.g. harmonising policies, influencing resources allocation, operational controls and documentation, information system, training and development, appraisal system, quality control, measuring and monitoring and communication and reporting. Assisting to balance and solve conflict between environmental management and other business objectives and priorities.
Follow up of effectiveness of environmental accountability along responsibility lines, organisation structure, work processes and assignment of responsibilities to employees.

To establish a process for communicating and reporting of environmental activities of the company in order to raise awareness to employees, communicate compliance and demonstrate management commitment to environment. For this purposes the following publications will be prepared, organisation's environmental profile, environmental policy objectives and targets and environmental performance evaluation.

5.0 PROJECT IMPLEMENTATION

5.1 GENERAL

TANESCO'S Research and Development under Environmental Unit will co-ordinate all activities for development and implementation of EMS. Services of local and foreign consulting firms and competent institutions and bodies such as University of Dar Es Salaam (UDSM), DoE, NEMC, NGO's and individuals will be utilised to provide expertise not available in TANESCO and where outside opinions on specific issues are required.

It is anticipated that Services of local and foreign firms, NGOs, Division of Environment (DoE) and National Environmental Management Council (NEMC)) and individuals outside TANESCO will be fully utilised in conducting meetings, seminars and education campaign to TANESCO employees. This approach has many advantages; the main ones being strengthening of local capacity, demonstrating due diligence and exposing the TANESCO EMS early to criticism.

The whole project period is 5 years; the first 2 years will be utilised for drafting the EMS whereas the last 3 yrs will be for initiating of its implementation. The draft final EMS will be concluded by a review report explaining the achievements, setbacks, and what need to be done to improve the EMS. The action plan and time-activity schedule are presented in Annex II and III, respectively.

5.2 ORGANISATION AND ADMINISTRATION

The department of Research and Development, which, is under Directorate of Corporate Planning and Research (DCPR) with the help of Environmental section will do the execution of this work. The department is headed by a Manager and Chief Engineer and it has another five informal sections; hydrology, survey, engineering geology and geotechnics and hydropower engineering The main tasks of Research and Development department, with others is dealing with environmental issues related to the company's activities and to undertake and performing pre-feasibility and feasibility studies for
TANESCO's power projects, monitoring of company's civil structures, supervision of construction works and. Over the years a department has acquired outstanding capability in terms of human resources, experience, skills, equipment and materials. The organisation chart of Research and Development department is shown as Annex I.

A department of Research and development has resourceful personnel with knowledge, expertise and experience for execution of the work, but some additional training is required to strengthen their capability. The experts have had close cooperation with foreign and local consultants.

Currently department of Research and Development with the help of environmental unit is, on behalf of TANESCO, coordinating and carrying out the auditing of existing 18 substations to be rehabilitated and upgraded. Also it carries studies of environmental and social impact assessment of transmission and distribution rehabilitation project for Dar es Salaam, Moshi and Arusha to be financed by World Bank. It is also working closely with Lower Kihansi Environmental Management project (in cooperation with NEMC). Further it does environmental planning and monitoring programmes for transmission and distribution system.

5.3 TRAINING

Essential to the functioning of the EMS is the staff awareness of environmental issues to enable them to carry out their daily activities appropriately. It is therefore important to conduct relevant training to various groups depending on the role each group plays in the implementation of EMS.

As stipulated in the previous proposals, an environmental awareness seminar, workshops and training to the management and the trainers is a prerequisite for the successful implementation of the EMS in TANESCO. Short-term environment management courses abroad are recommended for the TANESCO management team and environmental unit experts for raising awareness. It is anticipated that courses conducted by IHE Delft, Holland, IMAC and ACP Institutes Manzini Swaziland, ESAMI, ITC Holland, ICH of Norway are of meaningful and affordable. TANESCO should ensure that executing staff, management and even operational staff attend these courses.

Trainers and facilitators need to be equipped with appropriate skills and knowledge either in Tanzania or abroad. The best option would be to have a trip in the region such as South Africa and Zambia or other SAPP countries to learn from their experience. For staff who are expected to be permanently engaged in environmental issues, long term courses abroad are recommended.

5.4 EQUIPMEHT AND MATERIALS

Through TANESCO's major projects namely; PFRP, Kihansi and Power VI, Research and Development department has acquired equipment for field studies and office works. The
available equipment are enough for carrying out site investigations for dams, transmission lines, substations and shallow foundations. Also water quality analyses kits have been acquired. But due to the age and new technology some of the equipments like Decibel Meter, Air quality equipment, PCBs test kits, GPS, Digital camera and Equipments to measure radiation from electromagnetic waves have to be bought.

Recently there is growing laboratory testing capacity in the country. Testing facilities available at UDSM, Maji, materials Ujenzi, EAMRDC and elsewhere will be used for testing the samples.

6.0 BUDGET AND SCHEDULE

6.1 BUDGET

The budget for developing and initiating implementation of the EMS is about four hundred and seventy thousands US$ (US$ 509,628) as shown on Annex II.

6.2 SCHEDULE

The development of the EMS will take about 2 years and initiation of the implementation will take about 3 years. The schedule is presented as Annex III.
<table>
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<th>Activity</th>
<th>Action</th>
<th>Participant</th>
<th>Duration</th>
<th>Results</th>
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| Formulation of plan to fulfil the environmental policy | Develop environmental management programmes to achieve objectives and targets  
Establish procedure to identify, access, understand all legal, regulatory and other requirements  
Setting of overall goals for environmental performance identified in the environmental policy | Env. Section | 6 months | Specific environmental objectives & targets.  
-Environmental plans and management programmes with measurable performance indicators and conditions of reviewing and revising. |
| Formulation of implementation plan (aligning people, systems, strategy, resources and structure towards achieving environmental objectives) | -Identify the human, physical and financial resources for implementing EMS.  
- Establish Strategy to obtain the required resource from coy resource base and outside  
-Establish plans and programs to integrate EMS in the company management system (sub-unit policies, resource allocation, operation controls & documentation, information and support systems, training and development, organisation and accountability structure, measuring and monitoring systems communication and reporting etc.).  
-Establishing effective accountability and responsibility  
-Develop plans for disseminating Environmental awareness and motivation t to employee  
-Identify employees knowledge, skills and training requirements to achieve environmental objectives  
-Establish process to report internally and externally on environmental activities  
-Plan a system to manage, information identification, storage, retrieval, and dissemination. | Env. Section | 4 months | Human, physical (facilities & equipment) and financial resources and needs for implementing EMS.  
Plans to integrate policy and practices into each business as an essential management at all levels  
Established chain of command so that employees at all levels are accountable with their scope of their responsibilities.  
Identify knowledge, skills and training needs to achieve environmental objectives.  
Review of personnel selection and recruitment targets and development of skills. |
<table>
<thead>
<tr>
<th>Activity</th>
<th>Action</th>
<th>Participant</th>
<th>Duration</th>
<th>Results</th>
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</table>
| 5. Establish a system of monitor and evaluate environmental performance | Establish a system for measuring actual performance against the stated objectives and targets.  
- Establish a system for evaluation of compliance with relevant legislation and regulations  
- Establish a system to ensure reliable data are achieved  
- To establish indicators which are objective, verifiable, reproducible, and consistent with policy, practical, cost-effective and technologically feasible.  
- Establish a system for corrective and preventive actions? | Env. Section | 3 months | A system to ensure that the company is performing in accordance with stated environmental management requirements |
| 6. EMS records and information management                               | Establish effective EMS records/information management  
Establish system for environmental management system audits - Develop a procedure for receiving, documenting and responding to relevant information and requests from interested parties. | Env. Section | 3 months | Effective management of records (i.e. identification, storage, retention and disposition of EMS documentation and records. |
| 7. Implementation of EMS                                               | Conducting seminars, environmental meetings NGOS and implementing items 2-6 above                                                                                                                     | Env. Section/NEMC, UDSM | 3 yrs    | Systematic approach of addressing environmental issues (EMS) |
| 8. Review of the environmental management system and improvement        | Establish areas to be reviewed  
Set intervals for conducting a review  
Establish experts involved in the review | Env. Unit /with NEMC, UDSM, NGOS and individuals | 3 months | Evaluate a system for suitability and effectiveness.  
Feedback mechanism to ensure that planning, construction and operational activities and programs are proceeding as required and EMS is functioning the way it has been designed |

*Note: Some activities on the action are overlapping and will be carried out concurrently.
Annex I: Organisation of the Department of Environment in the Directorate of Corporate Planning & Research

DIRECTOR CORPORATE PLANNING & RESEARCH

Manager Research & Development

Manager Corporate Planning

Chief Research & Investigations Engineer

Chief Environmental Engineer/Officer

Senior Environmental Engineer/Officer

Monitoring & Audit

Environmental Experts

Environmental Experts

Senior Environmental Engineer/Officer

Environmental Impact Assessment

Environmental Experts

Environmental Experts
APPENDIX 07: TERMS OF REFERENCE (ToR)
Distribution and Transmission Rehabilitation Project
Environmental Audit

Terms of Reference (TOR)

Background
TANESCO and the International Development Association are preparing a distribution rehabilitation project component as part of the Songo Songo Gas Development and Power Generation Project (Credit 3569-TA). This component aims to improve the reliability and the quality of power supply to the consumer. The project will achieve the following objectives:
- Reducing the duration and frequency of power interruptions
- Improving voltage conditions at consumers’ premises
- Reduction of power system losses

The proposed project would consist of rehabilitation of 18 existing substations in Dar es Salaam, Arusha and Moshi as follows:

**Dar es Salaam**
1. Oysterbay
2. Mikocheni
3. Msasani
4. Factory Zone I
5. Factory Zone II
6. City Centre
7. Factory Zone III
8. Sokoine
9. Kurasini
10. Ilala

**Arusha**
11. Mount Meru
12. Unga Ltd.
13. Kiltex Ltd
14. Themis
15. Njiro

**Moshi**
16. Boma-Mbuzi
17. Lawate
18. Kiyungi

Furthermore, there will be a repair and upgrading of the 11/33 kV distribution systems in Dar es Salaam, Arusha and Moshi. A summary of the physical components of the project is provided in the table below.

**Physical Description of Rehabilitation of Distribution Facilities**

- Supply and installation of 22 additional 15MVA, 33/11kV transformers to relieve the overload in existing substations;
- Supply and installation of about 33 33/11kV circuit breakers; and some 124 11kV circuit breakers with associated switchboards;
- Installation of one 50MVA 132/33kV transformer with a circuit breaker at Kiyungi substation.
- Materials and equipment for repair/upgrading of the distribution systems which make a provision for the following: Reconductoring; Protection Systems; Autoreclosers Auto load break switches; Scada (distribution system); Sectionalizers; Boosters; Lightening protection; Distribution Transformers; New 33/11kV lines; Statistical Metering.
Objectives of the Environmental Audit

The objectives of this environmental audit are:

- To identify present environmental impacts and other environmental inadequacies on existing facilities. These include pollution, inadequate environmental management practices, and occupational health and safety issues in the facilities to be rehabilitated.
- To determine areas that need remedial actions and their potential costs necessary to bring these facilities into compliance with World Bank Safeguard Policies, and
- To recommend actions to improve and strengthen TANESCO's environmental, health and safety management.

Guiding Principles

A consultant will carry out a comprehensive Environmental Audit (EA) in accordance with and be fully responsive to IDA's "safeguard" operational policies and according to the existing laws and guidelines of the land (Tanzania). The audit report shall be subject to review by a Multi Sectoral Technical Review Committee team (TRC) under the supervision of the National Environment Management Council (NEMC). Upon acceptance by the TRC the audit document will be submitted to IDA in support of the proposed project.

Scope of Work

The environmental audit will focus on existing facilities to be rehabilitated. The activities of the audit will include:

- Review of Tanzania's relevant existing and pending environmental legislation, standards, and permits, as well as the country's occupational health and safety legislation.
- Review the relevant policies of the World Bank and its environmental, health and occupational health and safety guidelines, including the Pollution Prevention and Abatement Handbook (Electric Power Transmission and Distribution)\(^1\)
- Review all relevant existing in-house documentation, including compliance records and historical information.
- Meetings and consultations with TANESCO's facility management and relevant staff, relevant government and municipal/town authorities, environmental experts, people leaving around the subject substations and other bodies deemed necessary.
- Perform visual inspections of the substation sites and equipment to be rehabilitated.
- Identify all environmental (e.g., presence of hazardous wastes such as PCBs, water pollution, waste management practices, etc.) and occupational health and safety concerns related to both, past and ongoing activities in the facilities to be rehabilitated.

\(^1\) This can be found on the World Bank website [www.worldbank.org/](http://www.worldbank.org/)
Assess hazards or risks for local communities and the adequacy of procedures for warning and emergency responses (consult with community leaders, if appropriate)

Prepare a prioritized list of concerns (i.e. high, medium, low) related to past and ongoing activities in the facilities to be rehabilitated

Provide recommendations and cost estimates for the implementation of the required remediation action plan (work) and clean-up measures for both past and ongoing environmental and health and safety concerns in the facilities to be rehabilitated in relation to both, Tanzania and World Bank policies and standards

Identify the capacity to monitor the execution of the remediation action plan within and outside TANESCO and training needs to ensure efficient implementation of the Environmental Management Plan

Develop Environmental Management Plan for these substations which may be further developed to be adopted to other substations

**Reporting Requirements**

The draft environmental audit report should be prepared within 6 weeks from the date of study commencement (receiving the approved ToR from NEMC). The draft report shall be submitted to NEMC and the World Bank for review and comments. The comments shall be received within 5 weeks from the date when the draft reports were submitted. The final report, which includes the comments from NEMC and the World Bank, should be finished after one week from the date when the final comments are received. The report should be written in English, and should include an Executive Summary and should contain relevant maps. The final draft report will be final only after the acceptance and approval by the Government of Tanzania (NEMC) and the World Bank.

The report should contain a prioritized remediation plan if any, an Environmental Management Plan (EMP) and the associated costs. The report should also define the institutional responsibilities for the remediation, implementation of EMP, monitoring and for regular follow-up and the time frame.

**Audit Team Skills**

An environmental audit team should have necessary auditing skills as well as in depth knowledge of the environmental aspects of the electricity sector and competence in preparing environmental auditing.
Reinforcement and Upgrade of Dar es Salaam, Kilimanjaro and Arusha Transmission and Distribution System Project

The Environmental Audit Study Team

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