Ethiopia Privatization Program: Environmental Pre-audit of 155 Public Enterprises

Final Report

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Abbreviations and Acronyms

ACM	Asbestos Containing Material
BAT	Best Available Technology
BOD	Biochemical Oxygen Demand, Usually Measured Over Five Days.
BPT	Best Practicable Technology
COD	Chemical Oxygen Demand
CP	Cleaner Production
CPI	Cleaner Production Institute
CSM	Continuous Stack Monitoring
DDT	Dichlorodiphenyltrichloroethane
DO	Dissolved Oxygen
EA	Environmental Assessment
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
ESP	Electrostatic Precipitators
ETA	Ethionian Tanneries Association
GHG	Greenhouse Gas (Regarding Climate Change)
HACCP	
ISO	International Organization for Standardization
MOH	Ministry of Health
MoLSA	Ministry of Labor and Social Affairs
MoTI	Ministry of Trade and Industry
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxide
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
FEPAs	Federal Environmental Protection Authority
PM_{10}	Particulate Matter, 10 microns or less in Aerodynamic Diameter
PPE	Personal Protective Equipment
PPESA	Privatization and Public Enterprises Supervising Authority
PPM	Parts per Million
SMEs	Small and Medium (size) Enterprises
SO_2	Sulfur Dioxide
SPM	Suspended Particulate Matter
TOR	Terms of Reference
tpd	(Metric) tons per day
TSS	Total Suspended Solids
UNIDO	United Nations Industrial Development Organization
USAID	U.S Agency for Environmental Development
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound
WHO	World Health Organization

Executive Summary

The Government of Ethiopia (GoE), as part of its efforts to rebuild and vitalize the private sector intends to privatize 155 public enterprises (PEs). These enterprises cover key industrial sectors including textiles, tanneries, cement, glass, food processing, pharmaceuticals, and others.

Experience has shown that successful privatization of industrial enterprises is intertwined with qualitative and quantitative assessment of the post, current, and future environmental, health and safety (EHS) issues. Thus, evaluation of environmental issues related to PEs is crucial. Such as evaluation is also important for a potential buyer, for whom a major issue is the associated environmental liability as a result of a PE's purchase. Increasingly, financial institutions, as part of loan transactions are also requiring evaluation of potential environmental liabilities associated with purchase.

To help achieve the above objectives World Bank, as part of its privatization loan to the Government of Ethiopia (GoE), has provided technical assistance for environmental pre-audits of the 155 PEs. As a first step to privatization, environmental pre-audits can help broadly gauge an enterprise's environmental issues and the level of environmental audits required to assess potential liabilities. A list of PEs pre-audit is attached under Appendix A.

The 3½ weeks field study was assisted by a local technical staff of 4-6 personnel. The study indicates that of a total of 155 PEs pre-audited, 72 qualify for partial audit, and 24 for a full audit. Of the total PEs assigned, 2 PEs - Tigray Flour and Edible Oil, and Gonder Printing Enterprises could not be audited due to each's long distance (700 Km from Addis Ababa), limited flights, and difficulties in scheduling under the tight time- frame for the study. For the other two, Fincha Sugar and Methara Sugar, the industrial sector – sugar, is covered under other PEs. In addition, over 15 PEs either no longer are under PPESA, or are closed. No pre-audit was performed on these.

The study indicates that, almost all PEs visited have serious shortcomings in terms of environment, health and safety (EHS). Among the EHS issues, of particular mention are:

- Poor Operating Procedures;
- Obsolete, Often Poorly Functioning Equipment Adding to EHS issues;
- Weak Technical Management Capacity;
- Lack of quantity Assurance, Quality Control Procedures;
- No Cleaner Production Practices such as Recycle and Reuse; and
- Little to No Community Input

To meet the vast dimensions of the above and related issues, the lead agency, the Privatization and Public Enterprises Supervising Authority (PPESA), currently is very poorly equipped. Therefore, considerable PPESA strengthening is needed in terms of key resources. These include qualified staff, training equipment, adequate budgets and other needs met in a timely manner. In addition, inter agency cooperation particularly with Federal Environmental Protection Authority (FEPA), the Ministry of Health (MoH), and the Ministry of Labor and Social Affairs is crucial. Some details are provided in the report. In addition, background information on key environmental issues for major industrial sectors is also provided.

It is hoped that the study provided a useful input to the proposed privatization.

1.0 INTRODUCTION

Economic vitality, employment creation, and environmental protection are strongly interrelated. Increasingly, business community all over the world is recognizing that in light of globalization and the opening of trade and investment that accompanies it, large multinational companies can, through change in their business practices have the potential to impact sustainable development significantly. Experience has shown that all companies, regardless of size, sector or location, changes such as improved internal management of environment, and health and safety can make significant contribution to sustainable development.

For the business community, Ethiopia offers many investment opportunities. However, in terms of environment, the country lacks adequate environmental regulations, or the enforcement or infrastructure necessary to support them fully. In addition to strengthening the environmental regulations, adoption of international standards such as ISO-14000 by various enterprises can help improve not only environmental sustainability, but also Ethiopian exports. Thus, inviting businesses such as through privatization should be intertwined with environmental issues. This is because it:

- Results in a better privatization, providing for front-end environmental health and safety (EHS) due diligence and planning;
- Respects the principles of environmentally and socially sustainable development;
- Increases the level of acceptance of privatization by the public;
- Is more cost- and time-efficient; and
- Eliminates unnecessary duplication.

Thus, for long term success, Ethiopia must shift from a disconnected and fractured view of environment and development issues to a holistic, integrated concept of business and sustainable development. It may include environmental approaches such as shifting from end-of-pipe approach to pollution control to the use of cleaner, more efficient technology throughout entire production systems, openness and transparency, as well as open discussions with stakeholders. At present, many PEs are static, incorporate highly inadequate EHS measure and are loosing money. Such PEs offer significant opportunities for (CP) use. Full audits for cleaner production recommended PEs must identify CP opportunities.

As part of the corporate environmental management systems, in many countries, regular environmental audits are now commonplace. These audits contribute to information gathering for annual environmental reporting, demonstrate to regulators of compliance, and communicate to stakeholders of commitment to environmental protection. Environmental audits also enable business and organizations to systematically uncover wasteful and inefficient activities and minimize or eliminate exposure to regulatory penalties when potential violations are discovered. In the U.S. regulators are increasingly using periodic audits as their key compliance-monitoring tool. Moreover, Federal and State audit policies give penalty breaks to businesses, government agencies, and other organizations for certain violations discovered through voluntary environmental audits. The audits compare actual operational status to management's environmental performance expectations. Environmental audit to assess potential liability is now almost mandatory before financial institutions will accept a security.

In addition, third party audits are also common. These are undertaken by accredited certifying bodies to enable certification of an entity to standards such as ISO-14000. For this, an EMS is generally required. An EMS includes strategic planning activities, the organization's structure, and implementation of the environmental policy as an integrated part such as of a manufacturing process.

The International Standards Organization (ISO) defines an Environmental Management System (EMS) as: "---- that part of the overall management system which includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing, and maintaining the environmental policy."

The government of Ethiopia (GOE), with technical assistance from the World Bank, has initiated the process of privatizing over 125 public enterprises (PEs) in various sectors. A list of various PEs is attached in the Appendix. To date, the GOE has acquired some experience and expertise, and limited legislative support is also in place for privatization. For instance, one of its entities, the Ethiopian Privatization Agency (EPA), pursuant to the powers and duties vested in it by Article 19 of proclamation 146/No. 1998 was assigned the responsibility to transfer selected state-owned enterprises to private ownership. To date, EPA has privatized 200 units as well as whole enterprise, transferring them to domestic and foreign investors. Included are 44 enterprises sold to 1,454 workers organized under the GOE's Safety Net Program. Over the next two years, EPA, now part of Privatization and Public Enterprise Authority (PPESA), under the Ministry of Trade and Industry plans to privatize additional 113 public enterprises in various industries such as agriculture, chemicals, and pharmaceuticals.

Many of the Ethiopia's state-owned enterprises under the current study have increasingly shown poor financial performance. Many of these public enterprises (PEs) are industrial dinosaurs, seriously handicapped by an inheritance of outdated capital equipment, bureaucratic shackles, excessive labor, and poor operational practices. Finances, where provided, have been misdirected to investments in new equipment, whereas improvements in operational performance and good housekeeping could have meaningfully improved efficiency, and also brought noticeable environmental gains. Given this situation, the needed environmental management at these organizations has gone by the wayside. Based on experience elsewhere, it can be stated that one of the most effective ways of mitigating their environmental problems is through improvements in their financial performance and operational management. Experience has also shown that approaches such as use of subsides, low-interest credits, and other similar assistance has generally been ineffective. Often, it has meant throwing good money after bad. Thus, such enterprises must straighten out their overall performance, and then focus on environmental concerns, which will already be lessened because of the benefits of better operational practices.

In Ethiopia, since environmental regulations are not usually enforced and environmental agencies are weak, economic instruments are not of much help either. To introduce such systems as polluter-pays principle, a sound environment policy framework and strengthened institutional capacity of environmental agencies is a pre-requisite.

1.1 Project Description

Ethiopia's industrial sector with assistance from the World Bank has been identified as a major sector for the improvement and enhancement of the country's overall development for sustainable economic growth. The project's objectives are also consistent with the Ethiopia's Country Assistance Strategy (CAS). In addition, the country's overall poverty reduction strategy also revolves around improvement of competitiveness of the economy through better production, improvement of the quality of life, and enhancement of the productivity potential of public enterprises.

This project seeks to achieve these objectives via reform of the legal, institutional, and regulatory structures aimed at facilitating competitive private sector participation. A key element of this reform effort is the privatization of several public enterprises in various industrial sectors, as listed in the Appendix.

The project is headed by Agata Pawlowska, as the Task Team Leader for the World Bank Group. In addition, the Department of Public and Private Enterprises Supervising Authority (PPESA), as a Coordinator for the Reform Unit of the Ministry of Trade and Industry for the Government of Ethiopia is responsible for local co-ordination and support. The International Development Agency (IDA) of the World Bank is providing 25 million US dollars as an initial funding for the project.

Of the 125 PEs, this study covered over 120 public enterprises spread across Ethiopia, in a period of three weeks. A local technical staff of four (4) after initial training provided valuable support.

The field assessment team comprised of Dave Sood, the Lead Consultant. Mr. Sood has over 26 years of experience in environmental assessments, environmental audits, soil and water quality hazardous waste management and environmental impact assessments. He was supported by local technical staff of 4-6 personnel including Ato Fiseha Kebede, Textile Engineer, Yosef Arraya, Health Safety Expert, Meleke Bisrat, Mechanical Engineer, and Getachew Tarekegn, Health and Safety Specialist, Ms Hiwot Mekonnen provided office and administration support. Each of these individuals brought over twenty years of experience. In addition, Amadou Konare of the World Bank, Washington DC, reviewed the report for its compliance to World Bank's Safeguard Policies.

2.0 ETHIOPIA'S ENVIRONMENTAL SETTING

Ethiopia is the third largest country in Africa. The country's 2002 population is estimated at approximately 60 million. The country is endowed with a number of natural resources. For example, there are more than 5,770 species of animals, of which 10% is endemic to Ethiopia. In terms of flora, some 1,150 species are estimated to be endemic, though more research for identification is still needed. However, Ethiopia's flora and fauna have been significantly affected by industrial and agricultural development. For example, deforestation has considerably increased due to population pressures particularly in the highlands. Industrialization with little environmental control or compliance has increasingly polluted most of Ethiopia's 12 rivers and basins. Pollution levels of these rivers, especially those located in or around the Addis Ababa, Mojo, Debre Zeit and Kombolcha regions is high. For instance, in Oromiya region, three factories discharge their untreated effluents into Akaki River, three into Mojo River, and two into Sebeta River.

Other environmental issues of concern include soil degradation, and overgrazing. There are also bush fires. In addition, around the country there is also relatively low coverage and access to basic services such as electricity, water supply and sanitation, drainage, and solid waste collection and its environmental disposal. Water supply coverage throughout the country is estimated at 26% of the total population. Furthermore, national environmental issues and concerns have been exacerbated by the accelerated and unplanned industrialization. Some of the problems include the health impacts of pollution derived from inadequate management of wastes containing toxic elements and poor work ethics; inadequate waste treatment, and poor water, and air quality; poor sanitation, drainage and solid waste services and management; poor industrial hygiene; and poor industrial waste management.

Furthermore, there is also a serious lack of addressing of worker health and safety issues including, medical monitoring and providing appropriate industrial hygiene for workers. Hence, the essential elements are not adequately in place to mininiizing the negative effects deriving from the environmental concerns affecting the country.

2.1 Statutory and Institutional Aspects

The Federal Environmental Protection Authority (FEPA), has the responsibility for overall management of the country's environment. The agency has been continuously improving the environmental management initiatives. For instance, environmental management is gradually being integrated into the national policies for development in Ethiopia. It has published "Provisional Standards for Industrial Pollution Control in Ethiopia". However, extensive work is still required to develop and refine the specific EHS guidelines and regulations to accommodate the different sectors. The guidelines and standards also need to be developed for Ethiopia under the instructions and environmental assessment procedures described in the World Bank operational policy, procedures, good practices and safeguard policies i.e. OP/BP/GP4.01. Until these standards are developed specifically, it would be advisable to adhere to the standards by the World Health Organization (WHO), UNEP, or the European Union. These are considered comparable to those at the World Bank.

2.2 Post Pre-audit Institutional Arrangement

Based on the pre-audits, and also discussions with relevant technical and policy personnel, it can be concluded that there exists a serious lack of resources, including relevant experience and expertise, equipment and budgetary resources for conducting coherent monitoring and

enforcement of environmental management in Ethiopia. For instance, there are no methodologies for monitoring waste and toxic products in industrial effulents. A review also indicates a serious lack of standards for monitoring environmental parameters, i.e. measuring physicochemical and microbial parameters for such parameters as water quality and air quality, and noise. As a result, the enterprises; whether public or private, have not adhered to any standards, consistent or non-consistent. The Federal Environmental Protection Authority (FEPA), must therefore, provide guidelines and environmental performance indicators that are measurable and enforceable. As indicated earlier, the agency has made some progress in this direction. For example with assistance from UNIDO, in 2003, it published 'Professional Standards for Industrial Pollution Control In Ethiopia'.

The site visits indicate that a number of PEs, in particular, the sugar, tanneries and textile mills have been impacting negatively on the environment by primarily with noise, waste oil spills, asbestos released, smoke in the air, and contamination of the ground water. In most cases, the untreated wastewater had been and is being discharged into open drains or in few cases into city sewers, thereby negatively impacting the quality of life of residents.

Given the intertwined relationships between privatization and environment, the PPESA must work closely with FEPA, CPC, MoLSA, MoH and other relevant agencies to ascertain who and how the responsibilities for environmental liabilities for post-privatized PEs are assumed. Several issues would resolution. For example, do the liabilities fall on the new owners or on the former owners? Thus, all relevant agencies must work jointly in order to determine the appropriate law(s) covering environmental liabilities with respect to privatization policy, due diligence, and indemnification, so that there would be a clear understanding of who is liable for contamination, both past, current and in the future, i.e. during and after privatization. Unfortunately cultures of inter and intra-agency co-operation in Ethiopia is very weak. Inter-agency rivalries, overlapping authorities, and lack of GOE's directives cause of serious constraints. Unless mitigated or eliminated, an effective outcome will remain elusive. Coupled with this is a serious lack of technical and management capacity, and limited budgetary resources. The situation needs timely resolution. One suggested approach is to set up an inter-agency Advisory Committee to provide the above support. Members must also be included from the private sector and the citizens/NGOs.

- **Environmental Pollution Control Proclamation No. 300/2002**
  Section 2 articles 3, which state that "no person shall pollute or cause any other person to pollute the environment by violating the relevant environmental standards."

- **Public Health Proclamation No. 200/2000 Article 10 Sub article 3 Water Quality Control**
  It is prohibited to discharge untreated liquid wastes generated from the septic tanks, seepage pits and industries into water bodies.

- **Labor Proclamation No. 42/93**
  Part 7 article 10 sub-articles 1-8 which states that proclamations that "an employer shall take the necessary measures to safeguard adequately the health and safety of workers."

- **Labor Proclamation: Article 92, sub article 3: Obligation of an Employer**
  Provide workers with personal protective equipment (PPE), and clothing and material, instruct them of their use.

- **Public Health Proclamation 200/2000;**
  Part 4 articles 3, which state "it is prohibited to discharge untreated liquid waste generated from septic tanks, seepage pits and industries into water bodies, or water covergences." The same proclamation part 4 article 1 and 2 prohibits not to dispose solid or liquid or any other waste in a manner which contaminated the environment or affect the health of the society; and Part 5 section 20 which states "any employer shall ensure the availability of occupational health services."

- **Water Resource Management Proclamation 197/2000**
  Part 4 No. 13 States that "any application for a permit to release or discharge any waste, which endangers human life, animals, plants and any living things into water resources shall not be accepted. However, the supervising body may accept the application requiring the applicant to release or discharge after having treated the pollutant."

2.3 Pollution Management/Cleaner Production

Most approaches to bringing about a cleaner environment have relied on a philosophy of pollution control. This has involved sometimes-costly measures and controversial political decisions. As a result, developing countries, poor communities, and financially constrained enterprises have often argued that the environment is an expensive luxury that diverts resources from more productive uses. This perspective is giving way to a new paradigm stating that neglecting the environment can impose high economic and even financial costs, while many environmental benefits can in fact be achieved at low cost. For this to work, however, there is a need to better understand what motivates those responsible for pollution and their responses to different regulations, incentives, and pressures.

Moreover, for sustainable development, environment can no longer be viewed as a technical issue to be addressed independently from overall strategic decision making. The new approach can be summed up by the expression: environmental management, not just pollution control. The minimization of wastes requiring disposal is increasingly important as available disposal options become more and more constrained, and particularly as more substances enter everyday use that are not readily decomposed in the natural environment and that can present long-term hazards. Waste minimization basically involves avoidance of the generation of wastes, when practical, and the productive utilization of any wastes that are generated.

Thus, pollution prevention is always preferred to the use of end-of-pipe pollution control facilities. Therefore, every attempt should be made to incorporate cleaner production processes and facilities to limit, at source, the quantity of pollutants generated.

Cleaner production (CP), a widely used approach is inclusive of end-of-pipe treatment systems, but in a different solution development framework. CP is a series of environmental solutions, implemented in a logical sequence of small steps that leads to much smaller and cost effective end-of-pipe solutions. The objective is to introduce resource conservation and pollution prevention at source by implementing technically simple and cost-effective solutions. One notable example of the use of CP is at the Ethiopian Tanneries. Another example of use of CP is at Tabor Ceramics, a firm manufacturing tableware, sanitary ware and wall and floor tiles. As part of CP program, it has (a) partially substituted less polluting raw materials, (b) recycles and/or reuses defective raw material to save costs and minimize wastes, and (c) substituted high temperature demanding raw materials with those requiring low-temperatures.

2.4 EMS and ISO – 14000

As part of their environmental improvements, increasingly, organizations in a number of developing countries are streamlining their environmental performance through the use of environmental management system (EMS). An EMS is a program of continuous environmental improvements that follows a defined sequence of steps drawn from established project management practices and routinely applied in business management. Appendix Figure: *Implementing EMS-Key Elements of ISO-14000* graphically depicts an EMS process. Key elements of an EMS include:

- Review of the environmental consequences of the apparitions;
- Define a set of policies and objectives for environmental performance;
- Establish an action plan to achieve the objectives;
- Monitor performance against these objectives;
- Report the results appropriates; and
- Review the system and continuous improvement.

The best-known common framework for an EMS is the ISO-14000 series. This series is based on the overall approach and broad success of the quality management standards prepared and issued as the ISO-9000 series.

None the Public Enterprises (PEs) covered under the study follow, an EMS system. In most cases, it is because of the time and effort rather than out of pocket expenses. This is particularly true for the basic housekeeping and other similar improvements over time, other environmental elements can be added. Moreover experience has shown that, by implementing an EMS, enterprises, public or private can usually benefit from savings through clean production (CP) and waste minimization approaches. Experience with various industrial settings has also shown that up to 50% of the pollution generated in an "uncontrolled" plant can be prevented with minimal investment, by adapting simple, low-cost improvements. However, for a system to be successful, management and worker commitment to improving performance is essential. In addition, targeted training in management and quality control can also help improve overall performance including environmental aspects for small and medium enterprises (SME), which generally do not have a formal management structure and lack technically trained personnel. They may also have short- term cash flow problems, and implementing an EMS may present difficulties.

The cost of introducing an EMS generally depends upon the quality of management system and environmental performance. While costs may be a constraint for a number of PEs, it is important to note that, an EMS can be incrementally implemented as the resources permit. Thus, the EMS process can be started with simple procedures, and slowly changing to more sophisticated and complex one. Such an approach can be useful for small and medium enterprises. The Ethiopian environmental ministry should look into developing an EMS framework in the context of its industrial sector. Such a framework should also define the institutional lead for further developing and implementing the EMS.

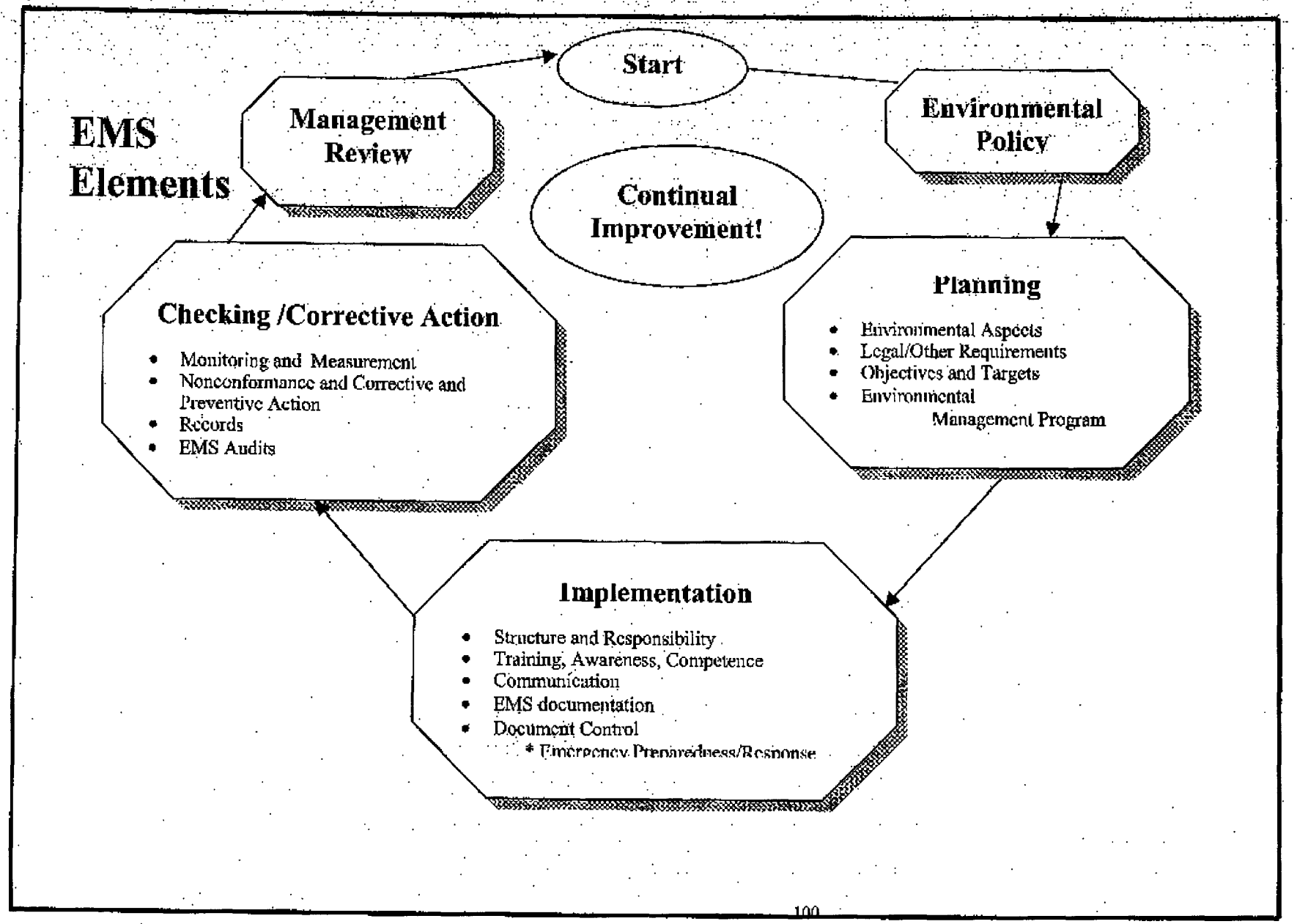


Figure No: 1 Implementing EMS-Key Elements of ISO-14000

3.0 AUDIT OBJECTIVES

An environmental audit (EAu) is an instrument to determine the nature and extent of all environments including occupational health and safety and social areas of concern at an existing facility or at a site. An EAu also assesses compliance with applicable legislation and with corporate policies. The audit identifies and justifies measures to mitigate the areas of concern, estimates the cost of the measure(s), and recommends a schedule for implementing them. For certain projects, an environmental audit may also act as an environmental assessment (EA), and for others, it may be the other-way around. In addition, an EAu must also consult and engage staff, affected groups of population, community-based and local non-governmental organizations (NGOs) about an enterprise's environmental, health and safety (EHS) aspects, and take their views into account. In addition, procedures for public participation and consultations must be flexible and not excessively burdensome, and responsive to the needs for expedited action and confidentiality.

Environmental audits help uncover deficiencies and lead to better environmental management practices. However, the enterprises should also help the process identify the "root causes" of each audit finding. Root causes are those breakdowns in management oversight, information exchange, and evaluation that allow environmental problems to recur. Thus, identifying and dealing with the root cause is usually more important than managing symptoms.

Environmental audits have many benefits. These include:

- Reducing liabilities and reduced potential for fines;
- Helping lower water and energy costs;
- Ensuring compliance with legislation;
- Good public relations;
- Potential to incorporate or improve health and safety; and
- Incorporating competitive advantage.

Compliance auditing is probably the most common form of environmental auditing. It is a verification process whereby the company establishes the extent to which it is complying with environmental legislation; discharge and emission consent limits, building permits etc. While a compliance audit may be relatively simple, it can be time consuming. More progressive compliance audits may extend to stricter standards and cover areas not yet legislated for, and form the basis for an environmental strategy.

The current study of 155 public enterprises (PEs) aims to broadly gauge the environmental, health and safety (EHS) and method classify them into the level of audit required. The approach and methodology used is indicated under section 4.0

4.0 PRE-AUDIT METHODOLOGY, EVALUATION AND RANKING CRITERIA

The 155 PEs assigned for an environmental pre-audit were selected by PPESA as a part of GOE's divestiture program. The study team visited each (except 4 – see table 2) of the facilities for visual observations, discussions with relevant senior staff as well as review of available documents and records. A checklist (section 4.1.1), sometimes specifically tailored to a particular facility due to its industrial nature was also used.

This information was critically analyzed and broadly reviewed in terms of relevant Ethiopian environmental regulations and the risk posed to various environmental receptors following the evaluation criteria mentioned under section 4.0 a ranking of each of the 155 PEs was done. Based on this ranking, each PE was classified in one of the following three environmental audit candidates.

- Pre-audit: Minimum risks
- Partial audit: Some risks perceived
- Full audit: High risk, need detailed audit

Annex Table 1: *Level of Environmental Audit and Key EHS Issues at Each PE* lists all PEs along with the suggested level of environmental audit required for each PE.

In order to determine the level of audit required by each of the public enterprises (PEs) under study, the above classification was based on risk characterization was carried out. The risk characterization is a process of estimating the probable incidence of adverse impacts to potential receptors under various exposure conditions including an elaboration of uncertainties associated with such estimates. The ranking is based on the qualitative estimation of the potential risks and/or hazards due to activities carried out by each of the PEs.

An adequate characterization of risks and hazards at a potentially contaminated site is useful for a comprehensive (full) environmental audit. Such characterizations generally include the past, current and potential EHS hazards. This work may include an in-depth review of documents including analytic data, to the extent available and other information. For a full audit, all information should be carefully analyzed to develop costs of remediation as well as legislative compliance costs and requirements. Cleanup criteria should be developed based on the 'acceptable' level of risks to potential receptors, with in the context of Ethiopia. Furthermore, during the comprehensive audits, the greatest risk can be identified and the site mitigation measures selected to address those issues.

The ranking procedure used is similar to the scoring under the DRASTIC Index used by USEPA. It is based on risk characterization of hazardous wastes. This ranking approach can also provide indication on whether the PE site is located in a generally sensitive or vulnerable area and the level of pollution potential to the environment.

4.1 Checklists

The checklist delineates what should be evaluated during an audit. Good management practices should be distinguished from the regulatory requirements. The pre-audit team was provided with a checklist covering all key elements. Included were (1) the production process including the flow diagrams, the major pollutants at each stage etc, the byproducts, the types and quantities of chemicals used and the production capacity, (2) types and quantities of wastes generated, (3) pollution from noise, dust, blast, and vibrations, (4) procedures to manage wastes including pretreat merit, and (5) occupational safety and health issues. As the experience was gained this checklist was modified. This included adding PE-specific questions.

4.2 Rating Components:

The rating components for evaluating and characterizing the audit level of a PE was based on:

- Type of Enterprises (i.e. activities at facilities and sites);
- Emissions and Air Quality;
- Wastewater (i.e. impact on surface water and ground water receptors);
- Waste Oil and Spill Control Measures;
- Solid Waste;
- Noise, dusts etc.;
- Occupational Health and Safety Issues;
- Environmental Management and Regulatory Framework; and
- Capacity Building, Training and Awareness (of environment and also of the proposed privatization)

The audit evaluation factors were assigned rating components ranging from one (1) to ten (10); with the least significant rated as 1 and the very significant rated as 10. The Audit Factors were incorporated into a relative ranking scheme that used a combination of weights and ratings to produce a numerical value called Audit Index.

4.3 Weighting Components:

The weighting was assessed on the overall effects o pollution potential for the sites and facilities of the PEs by considering the weighting components as follows:

* Depth to water;
* Soil and aquifer media;
* Topography;
* Impact on land-use and planning;
* Impact on wetlands and water bodies; and
* Impact on workers

The public enterprises reviewed were assigned scores on the basis of the Audit Index Factors (AIF) developed for the various facilities. The AIF is a degree of pollution potential for a facility by which assessment for comprehensive audits can be determined. The environmental parameters with little impact on the environment were assigned the lowest scores of one (1). The criteria with signification impact on the environment were assigned the highest score of ten (10). The scores for each enterprise were then summed and the site with the highest score assigned the most likely site to have fill audit to be undertaken.

Thus, each audit factor has a relative weight ranging from one (1) to five (5); the least significant with a weight of 1 and the very significant with weight of 5. For example, a component such as 'Air Emission' was assigned a weight of 5 if the impact to the environment was very significant, (such as burning used oil in an enclosed room, a situation observed at the Nazareth Edible Oil Factory). A weight of 1 was assigned if the impact to the environment was of least significance.

To obtain the number of each of Audit Index Factor (AIF) that determined the degree of the pollution potential, the weight was multiplied by the rating. The total of the product for individual Audit Factor gave the Audit Index. Evaluation of the Audit Index for a PEs provided the relative significance of each facility with respect to the pollution potential.

Based on the cumulative Audit Index Factors, the PEs were ranked into categories of those that required comprehensive (full) audits, those that required partial audits and those where the current pre-audit was considered sufficient.

The information generated as a result of site visits was further evaluated through the use of the rating (Section 4.2) and weighting (Section 4.3) components in order to arrive at a numerical score for each PE. The ranking were categories as follows:

- PEs with Audit Index Factors of cumulative scores above 140 were considered as high risk, thereby requiring full (comprehensive) audits.
- PEs with Audit Index Factors of cumulative scores ranging from 100-140 were28 considered as medium risk and would require partial audits.
- PEs with Audit Index Factors of commutative scores less than 100 were considered as low risk and would require no audits.

It must be noted that in using the above rating and weighting components (section 4.3), in addition to using the information generated for each PE (Appendix A (1) and (2)) a degree of judgments based on applicable industry experience was also used. This was necessitated due to weak, unreliable or no information available for one or more needed elements as indicated under section 5.0. We believe this approach helped to arrive at a more accurate rating in the context of the indicated limitation for each PE. The team was also instructed on matters related to human interaction, considered useful in interviewing.

5.0 ENVIRONMENTAL PRE-AUDITS OF PROPOSED PEs FOR PRIVATIZATION

This study covers environmental pre-audit of 129 public enterprises (PEs) that are targeted by the GOE for potential privatization. These PEs are spread across Ethiopia, a number of them over 500 Kms from Addis Ababa. They cover several industrial sectors including agriculture, beverages, cement, chemicals, printing tanneries, textiles and others, as listed under Appendix B. Given the weak environmental regulations and their lax enforcement, combined with outdated, often poorly maintained equipment by inadequately trained staff, most of the PEs offer strong potential for continuing environmental contamination.

During visit, unhygienic and unsafe working conditions were noticed at most of these PEs. For instance, used oil is burnt is rooms with little or no ventilation. Given the use of obsolete equipment, the oil spills observed in the work areas, the ambient environment has a strong potential to present serious health risks especially from air-borne and other contaminants. For instance, the strong odor in the furnace room at the Nazareth Edible Oil Factory prevented the pre-audit team from going into the room to assess the situation fully. At this facility, two factory workers indicated that they regularly work inside the furnace room. Similar situation was observed at a number of other PEs pre-audited under this study. Another example is used oil, which if improperly handled or used, can be a serious environmental contaminant (see Appendix B). Other EHS related observations that are common to almost all PEs visited include:

- **Poor and/or Inadequate Operating Procedures.**

Here, the key items include lack of or in operational system or plant for wastewater treatment; improper disposal of by product sewage sludge; discharge of in to open drains and /or city's drainage system and overall poor operational procedures endanger worker health and safety. Most PEs visited do not have good records such as daily log sheets of input and output. It is, therefore difficult to assess how much waste is being generated and of what type(s). These include unclean and/or slippery floors, absence of or inadequate use as gloves and masks, where needed, and presence of hazardous wastes, especially oil spills around the factory compound or inside work areas. In addition, friable asbestos that, when airborne and inhaled, can seriously endanger human health (see Appendix B) was also noticed in at a number of PEs.

- **Obsolete, and/or Poorly Functioning Equipment.**

Use of old, poorly maintained equipment offers strong potential for increased worker health and safety. Such equipment use is common to most PEs visited. Of particular concern is the burning of used oil in poorly maintained furnaces, and also old manufacturing machinery, where high level of noise and leaking fluids of unknown composition was also observed.

- **Weak Technical Management Capacity**

Combined with inadequate budgets, shackled bureaucracy, and lack of regulatory legislation, coupled with poor or no EHS enforcement poses serious problems for an effective environmental management. None of the 155 PEs, including the large ones visited any individual in-charge of environmental health and safety issues. There are very few exceptions to this. As an example, at the Ethiopian Tanneries, the Production Manager seems to be

(somewhat effectively) performing this function. This conclusion was derived from discussions and review of few documents at the plant. The tannery is the process of getting an ISO-14000 certification and as a result, it hopes to significantly increase its exports. In the long run, better environmental management can contribute to increased productivity.

- **Lack of QA/QC Procedures**

As far as EHS issues are concerned, only 2 PE's, including the Ethiopian Tannery have some level of quality assurance and quality control procedures. These procedures are essential to work health and safety, cleaner environment, verifiable procedures and other benefits, all also potentially leading to higher, qualitative outputs. For instance, Quality Assurance (QA) assures that measurements meet defined standards of quality and with a standard goal. Quality Control (QC) on the other hand includes preparing protocols (including standards operating procedures and record keeping) for site operation and equipment maintenance; preparing protocols for equipment calibration; preparing site visit schedules; and preparing protocols for data inspection, review, validation and usage. QA includes developing a schedule for audits and reports. Likewise, no records are kept of accidents occurring at the PEs.

- **No Recycle, No Reuse of Wastewater, Etc.**

Almost all PEs visited do not recycle or reuse their wastewater or where environmentally and cost-effectively feasible. Use hazardous wastes such as for incineration is also not practiced. The FEPA regulations recommend these practices. For example, for the tanning industry, in soaking and pickling reuse of factory's wastewater is recommended by FEPA. Likewise, the agency recommends recycling of chrome after precipitation and acidification. All such practices are also in line with recommendations of Ethiopia's Cleaner Production Center (CPC) as well as international standards.

- **Lack of Community Participation and Input**

A number of PEs are located within or in close proximity to city centers. Given the existence of adverse environmental contamination and health effects, the impact on surrounding communities, as well as grievances when presented to the authorities have been ignored and buried in the bureaucratic red tape. Lack of knowledge and awareness of the adverse impacts of various pollutants also adds to the magnitude of such impacts.

- **Potential Decommissioning**

Out the EHS issues the pre-audit team also observed that a number of the PEs visited may require partial or full decommissioning plants to dismantle, remove and transport to safe disposal sites, obsolete plants. It is suggested that PPESA, with partnership and guidance of FEPA should develop a PE-specific decommissioning plan. The World Bank regulation requires as environmental assessment (EA) and last estimates. To the extent environmentally- and cost-effectively feasible, decommissioning plants can include recycle and reuse of environmentally salvageable components.

5.1 Pre-audit for 155 PEs Proposed by PPESA

5.2 Review of Pre-audits at 20 PEs Completed Under the African Development Bank

Of the 155 PEs targeted for coverage under the current study, approximately 20 PEs earlier were pre-audited by the African Development Bank (AfDB) under its assistance to PPESA. These PEs, however were revisited in a broad-brush approach and pre-audits redone to bring them to current status and also to meet the World Bank requirements.

Various pre-audits completed are attached under *Appendix A 1: Environmental Pre-audit Information for 155 PE and Appendix A 2: Environmental Pre-audit Information for 20 AfDB Completed PEs.*

The write up for each synopsizes key environmental issues. Based on the site visit, discussions with relevant officials, knowledge of the industry, review of the Ethiopian environmental legislation, guidelines and standards, to the extent available and applicable and use of criteria indicated under section 4.0 each of the PE was classified into level of audit required.

6.0 RESULTS OF RANKING

The result of 155 PEs audited is shown in the attached table: *Level of environmental Audit and Key EHS Issues at Each PE.*

The results of 155 PEs audited are summarized as follows.

Full audit	24
Partial audit	72
Pre-audit	44
No audit	15
TOTAL	155

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
A.	AGRICULTURE		
1	Abobo Agricultural Dev't Enterprise	Full	* Handling of hazardous chemicals
2	Agricultural Equipment & Technical Service Enterprise	Partial	* Oil spills * Asbestos * Dirt
3	Agricultural Input Supply Enterprise		
4	Agricultural Mechanization Service Enterprise	Pre-audit	Insignificant Environmental Impact
5	Arsi Agricultural Dev't Enterprise	Full	* Potentially adverse EHS impact
6	Awassa Agricultural Dev't Enterprise	Full	* Improper handling of toxic chemicals.
7	Bale Agricultural Dev't Enterprise	Full	* Improper use and disposal od chemicals
8	Coffee Plantation and Dev't Enterprise	Partial	* Oil spills * Untreated wastewater discharge
9	Coffee Processing & Warehouse Enterprise	Partial	* Dust * Untreated water Discharge
10	Dairy Development Enterprise	Pre-audit	Insignificant Environmental Impact
11	Ethiopian Fruits & Vegetables Enterprise	Partial	* Oil Spills * Fuel tank exposed for fire * Untreated effluents disposal
12	Horticulture Dev't Enterprise	Partial	* Handling and use of hazardous chemicals
13	Middle-Awash Agricultural Dev't Enterprise	Partial	* Pesticide spray * Dust * Asbestos
14	Semen-Omo Agricultural Dev't Enterprise	Partial	* Handling of hazardous chemicals
15	Tendaho Agricultural Dev't Sh. Co.	Partial	* Asbestos * Pesticide spray * Untreated wastewater * Dust
16	Upper Awash Agro-Industry Enterprise	Partial	* Untreated wastewater disposal * Oil spills * Asbestos
17	National Veterinary Institute	*No more under PPESA*	
B.	BANK AND INSURANCE		
18	Commercial Bank of Ethiopia	*Not to be covered as per PPESA (Mr. Netsanet Wondirad)*	
19	Construction & Business Bank Sh. Co.		
20	Ethiopian Development Bank		
21	Ethiopian Insurance Enterprise		

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
C.		BEVERAGE	
22	Ambo Mineral Water Factory	Partial	* Oil spills * Asbestos
23	Assela Malt Factory	Partial	* Bad smelling wastewater * Use of freon gas
24	Awash Winery Sh. Co.	Pre-audit	Insignificant Environmental Impact
25	Babile Minerat Water Factory	Partial	* Noise * Untreated wastewater * Asbestos * Oil spills
26	Bedele Brewery Sh. Co.	Partial	* Oil spills * Piles of used bottles
27	Harrar brewery Sh. Co.	Partial	* Oil spills * Open storage of hydro chloric acid
28	Meta Brewery Sh. Co.	Full	* Improper disposal of broken bottles, crown corks & untreated water * Leakage of toxic ammonia * Dust
29	National Alcohol & Liquor Factory	Partial	* Oil spills * Asbestos * Lots of broken bottles
D.		CEMENT	
30	Mugher Cement Factory	Partial	* Dust * Emission of calcium carbonate
E.		CHEMICAL	
31	Adami Tulu Pesticide Processing Sh. Co.	Partial	* Toxic nature of products (no EHS violation)
32	Addis Ababa Bottle & Glass Sh. Co.	Partial	* Emssion of sulfur dioxide
33	Addis Ababa Foam & Plastic Factory		*Closed Facility*
34	Alkyd Resin Sh. Co.	Partial	* Untreated effluents discharge
35	Awash Melkassa Aluminum Sulfate & Sulfuric Acid	Partial	* Potentially hazardus chemicals
36	Caustic Soda Sh. Co.	Full	* Untreated wastewater disposal
37	Chora Gas & Chemical Factory	Partial	* Untreated wastewater disposal * Emission of calcium hydroxide
38	Nazareth Soap Factory	Partial	* Fumes and toxic vapors * Smell of furnace oil * Untreated effluents discharge
39	Nifas Silk Paint Factory	Full	* Bad smells * Use of toxic chemicals * Untreated wastewater discharge
40	Reppi Soap Factory	Partial	* Overflow of effluents to nearby streams

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
F.	CONSTRUCTION		
41	Addis Block Production Sh. Co.	Partial	* Dust * Oil spills * Untreated wastewater discharge
42	Awash Construction Sh. Co.	**Entry refused inspite of written permission**	
43	Batu Construction Sh. Co.	Partial	* Oil spills * Excess noise * Dust
44	Blue Nile Construction Sh. Co.	Pre-audit	* Dust but no environmental impact
45	Bricks Products Production Sh. Co.	Partial	* Oil spills
46	Building Materials & Supplies Enterprise	Pre-audit	Insignificant Environmental Impact
47	Cemental Materials & Supplies Enterprise	Pre-audit	Insignificant Environmental Impact
48	Construction Design Sh. Co.	Pre-audit	Insignificant Environmental Impact
49	National Engineers & Contractors Enterprise	Partial	* Oil sludge * Untreated wastewater disposal * Piles of solid waste
50	Residential Houses Construction Enterprise	Pre-audit	Minimum environmental impact
51	Transport Construction Design Enterprise	Pre-audit	No environmental impact
52	Water Works Construction Enterprise	No pre-audit is carried out as the enterprise is no more under PPESA	
G.	FOOD		
53	Ada Flour & Pasta Factory	Pre-audit	Insignificant Environmental Impact
54	Adama Edible Oil Factory	Partial	* Dust * Oil spills * Bad smell * Untreated liquid waste
55	Addis-Mojo Edible Oil Complex Sh. Co.	Partial	* Untreated waste materials discharge * Inappropriate hexane storage
56	Awassa Flour Factory	Pre-audit	Insignificant environmental impact
57	Bahir Dar Edible Oil Sh. Co.	Partial	* Untreated effluents discharge
58	Dire Dawa Food Complex Sh. Co.	Pre-audit	Insignificant environmental impact
59	Ethiopian Spice Extraction Factory	Partial	* Dust * Asbestos * Oil spills * Untreated wastewater
60	Fafa Food Sh. Co.	Partial	* Bad odor * neglected effluents
61	Hamaressa Edible Oil Sh. Co.	Partial	* Asbestos * no chemical waste treatment
62	Kaliti Food Sh.Co.	Partial	* Oil spills * Untreated wastewater discharge
63	Kokeb Flour & Pasta Sh. Co.	Pre-audit	Insignificant environmental impact
64	Misrak Flour & Bread Factory	Pre-audit	Insignificant Environmental Impact

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
65	Nazareth Edible Oil Factory	Partial	* Dust * Oil spills * Asbestos * Untreated wastewater discharge
66	Tigray Flour & Edible Oil Sh. Co.		Not completed/Inaccessible
67	Yerer Flour Sh. Co.	Partial	* Asbestos * potential pollution
68	Ethiopia Hotels Enterprise	Pre-audit	Insignificant environmental impact
69	Ethiopian Tourist Trading Enterprise	Pre-audit	Insignificant environmental impact
70	Ghion Hotels Enterprise	Pre-audit	Insignificant environmental impact
71	Ras Hotels Enterprise	Pre-audit	Insignificant environmental impact
72	SPA Service Enterprise	Pre-audit	Insignificant environmental impact
73	Wabishebelle Hotels Enterprise	Pre-audit	Insignificant environmental impact
H.	LEATHER		
74	Addis Ababa Tannery Sh. Co.	Partial	* Untreated wastewater discharge
75	Anbessa Shoe Sh. Co.	Pre-audit	Insignificant environmental impact
76	Blue Nile Shoe Sh. Co	Pre-audit	Insignificant environmental impact
77	Combolcha Tannery Sh. Co.	Full	* Unpleasant smell * Untreated water
78	Ethiopia Tannery Sh. Co.	Full	?
79	Modjo Tannery Sh. Co.	Full	* Unhygienic operation *Untreated wastewater discharge * Use of toxic chemicals
I.	METAL		
80	Ethiopian Crown Cork & Can Factory Sh. Co.	Partial	* Gas fumes * Bad smell and excess noise * Oil spills * Untreated effluents discharge
81	United Abilities Factory	Partial	* Nickel plating * Oil spills * Asbestos
J.	MINING & MINERAL		
82	Bole Bulbula Construction Stone Production Sh. Co.	Partial	* Oil Spills * Dust
83	Ethiopian Petroleum Enterprise	Pre-audit	No environmental impact
84	Adola Gold Development	Partial	* Untreated potable water supply
K.	OTHERS		
85	Industrial Project Service	Pre-audit	No environmental impact
L.	PHARMACEUTICAL & HEALTH		
86	Ethiopian Pharmaceutical Manufacturing Sh. Co.	Partial	* Untreated wastewater discharge
87	Pharmaceutical and Medical Supply Sh. Co.	Partial	* Handling of Toxic Chemicals
M.	PRINTING		
88	Berhanena Selam Printing Enterprise	Full	* Lead fumes and dust * Toxic wastes * Potentially hazardous chemical storage

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
89	Educational Materials Production & Distribution	Partial	* Emission of gas * Accumulation of wastes of calcium sulphate, acryliplastic and other potentially toxic wastes
90	Ethiopian Pulp & Paper Factory Sh. Co.	Partial	* Untreated fiber, wastewater and dyestuffs
91	Gondar Printing Enterprise	*Not completed/Inaccessible*	
N.	**PROJECT**		
92	Coal-Phosphate Fertilizer Complex Project	Pre-audit	No environmental impact
O.	**SUGAR**		
93	Addis Ketema Candy Factory	Pre-audit	Insignificant environmental impact
94	Ethiopian Sugar Industry Support Center Sh. Co.	Pre-audit	No environmental impact
95	Fincha Sugar Factory	*Factory CLOSED for maintenace*	
96	Methara Sugar Factory	*Factory CLOSED for maintenace*	
97	Wonji Sugar Factory	Full	
P.	**TEXTILE**		
98	Addis Garment Sh. Co.	Pre-audit	Insignificant environmental impact
99	Akaki Garment Sh. Co.	Pre-audit	Insignificant environmental impact
100	Akaki Textile She. Co.	Full	* Use of toxic chemicals * Asbestos * Untreated wastewater discharge * Oil spills
101	Arbaminch Textile Sh. Co.	Partial	* Untreated effluents discharge
102	Awassa Textile Sh. Co.	Full	* Untreated wastewater discharge
103	Bahir Dar Textile Sh. Co.	Full	* Untreated wastewater discharge * Oil spills
104	Combolcha Textile Sh. Co.	Full	* Asbestos * Untreated wastewater discharge * Oil spills
105	Dire Dawa Textile Factory	Full	* Untreated waste materials discharge * Noise pollution * Asbestos
106	Edget Yam Factory	Full	* Asbestos * Untreated wastewater discharge
107	Ethio-Japan Synthetic Textile Factory Sh. Co.	Full	* Untreated wastewater discharge
108	Gullele Garment Sh. Co.	Pre-audit	Insignificant environmental impact
109	Nazareth Garment Sh. Co.	Pre-audit	Insignificant environmental impact
110	Nifas Silk Thread Factory	Full	* Asbestos * Untreated wastewater discharge
Q.	**TRANSPORT**		
111	Anbessa City Bus Service Enterprise	*No more under PPESA*	
112	Bekelcha Transport Sh. Co.	Pre-audit	* Untreated wastewater discharge

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
113	Comet Transport Sh. Co.	Partial	* Heap of sludge * Untreated wastewater * Heavy smoke with soot * Dust * Asbestos
114	Ethiopian Shipping Lines Sh. Co.	Pre-audit	No environmental impact
115	Maritime & Transit Service Enterprise	Pre-audit	No environmental impact
116	Shebelle Transport Sh. Co.	Partial	* Oil spills * Wastewater discharge
117	Walia Inter-City Bus Service Enterprise	Partial	* Oil spills * Wastewater discharge
118	Woyra Transport Sh. Co.	Pre-audit	Insignificant environmental impact
119	Ethiopian Grain Trade Enterprise	*No more under PPESA*	
120	Procurement Service Enterprise	Pre-audit	No environmental impact
121	Merchandise Wholesale & Import Trade Enterprise	Pre-audit	No environmental impact
R.	WOOD		
122	ECAFCO Sh. Co.	Partial	* Friable asbestos * Excess noise * Dust
123	ETHARSO Sh. Co.	Partial	* Dust * Unsafe hazardous wastes
124	Ethiopia Plywood Factory	Partial	* Dust * Excess noise * Oil spills
125	Sawmills & Joineries Enterprise	Pre-audit	Insignificant environmental impact
S.	BASIC METAL AND ENGINEERING ENTERPRISE		
126	Abay Technical Service Enterprise	Partial	* Oil spills * Untreated wastewater discharge
127	Addis Spare Part Import and Distribution Sh. Co.	Pre-audit	No environmental impact
128	Akaki Metal Products Factory	Partial	* Noise * Dust * Fumes and smoke * Oil spills
129	Akaki Spare Parts & Hand Tools Sh. Co.	Full	* Untreated wastewater discharge * Asbestos * Piles of silica sand with resin
130	Ethiopian Iron & Steel Factory	Full	* Dust * Fumes * Noise * Oil spills * Untreated wastewater discharge
131	Ethiopia Plastic Sh. Co.	Partial	* Dust * Noise * Use of toxic chemicals
132	Kotebe Metal Products Factory	Partial	* Smoke and soot * dust * Oil spills
133	Kolfe House Hold & Utensils Factory	Partial	* Improper chemicals storage * Fumes and vapors * Smoke and dust * Untreated wastewater
134	Nazareth Tractor Assembly Factory	Partial	* Oil spills * High noise * Untreated wastewater discharge
135	Zuquala Steel Rolling Mill.	Pre-audit	Insignificant environmental impact

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No: T.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
	Environmental Audits by Ethiopian Environmental Authority/African Dev't Bank		
1	Fish Production & Marketing Enterprise	Partial	* Use of freon gas * Poor offal disposal system * Untreated wastewater discharge
2	Coffee Technology Dev't & Engineering Enterprise	Partial	* Oil spills * Potential land degradation * Untreated effluents openly discharged
3	Natural Gum Production & Marketing Enterprise	Partial	* Dangerous animals and reptiles in work area * High amount of Dust
4	Ethiopian Marble Industry	Partial	* Proplem of wastewater disposal * Heap of mud
5	Prefabricated Building Parts Construction Enterprise	Partial	* Oil spills * High amount of dust * Untreated wastewater discharge
6	Tabor Ceramics Sh. Co.	Partial	* Handling of chemicals *Release of left over dust by extractor
7	Water Well Drilling Enterprise	Partial	* Untreated effluents dishcarge * Oil spills * Irritating gas and fumes in work areas
8	National Tour Operation Enterprise	Partial	* Untreated wastewater dishcarge * Oil spills
9	Ethiopian Rubber & Canvas Shoes Factory	Full	* Oil spills * Potentially friable asbestos * Improper storage of chemicals (some of unknown origin) * Untreated wastes disposal
10	Abiyata Soda Ash Sh. Co.	Pre-audit	Insignificant environmental impact
11	Ethiopian Mineral Development Sh. Co.	Pre-audit	Insignificant environmental impact
12	Artistic Printing Enterprise	Partial	* Existence of chemicals and petroleum products of unknown composition * Lead and dust * Untreated wastewater drained into city system
13	Bole Printing Enterprise	Partial	* Lead dust * Untreated wastewater drainage
14	Commercial Printing Enterprise	Partial	* Lead dust * Improper storage of chemicals * Untreated wastewater drainage
15	Yekatit Paper Converts Enterprise	Partial	* Untreated wastewater disposal * Dust, air emissions (VOC)
16	Adey Ababa Yarn Sh. Co.	Full	* Dust * Untreated wastewater discharge * Improper storage of Chemicals
17	Ethiopian Fiber Products Factory	Pre-audit	Insignificant environmental impact

Table 1: Level of Environmental Audit and Key EHS Issues at Each PE *(continued)*

Sr. No.	Name of the Enterprise	Level of Audit Required	Key EHS Issues
18	Debre Berhan Blanket Factory	Partial	* Oil spill * Dust * Asbestos * Use of toxic chemicals * Untreated wastewater discharge
19	Meher Fiber Products Factory	Partial	* Dust * Untreated effluents discharge
20	Kaliti Metal Products Factory	Pre-audit	Insignificant environmental impact

7.0 POST PRE-AUDIT PRIVATIZATION

In privatization of the PEs, the new investor or owner would need encouragement and incentives as well as protection against potential environmental health and safety (EHS) liabilities and uncertainties of future environmental framework. However PPESA, the lead agency in-charge of the proposed privatization is neither an environmental regulatory or management authority nor does it invest in both public and private enterprises and environmental clean-up activities. Figure 1 shows an Organizational Chart for PPESA.

7.1 PPESA: The Lead Privatization Agency

Privatization and Public Enterprise Supervising Authority (PPESA) is the lead agency responsible for the proposed privatization of 155 PEs. Figure 2 shows its Organizational Chart.

The organization under the Ministry of Trade and Industry is headed by a Director General. Within PPESA, the proposed privatization will be spearheaded by the office of the Deputy Director General (Privatization). Currently, this Deputy Director General, in addition to managing its four divisions, namely Privatization, Preparedness and Implementation; Development Project Studies and Joint Ventures; Post Privatization Joint Venture Follow Up; and Finances is also managing the other four divisions of PPESA, as shown in Figure 2: *PPESA-the Privatization and public enterprises supervising authority*. However, near-term, PPESA plans call for assigning the four divisions to a new Deputy Director.

Under the Post-Privatization, Joint Venture and Follow Up Division, there are two subdivisions. These are: Impact Analysis Subdivision and Follow Up Subdivision. The Follow Up Subdivision is responsible for contract management, labor, environmental (post-privatization), and related issues. This subdivision will be the lead for all environmental related issues of post-privatization.

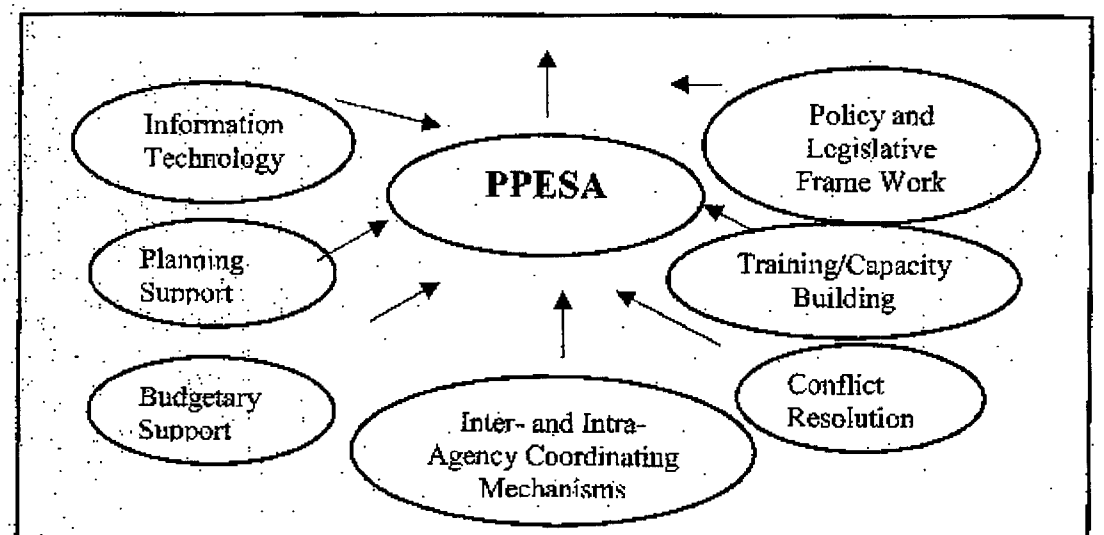


Figure: 3 PPESA: Institutional Strengthening for Post- Privatization

However, in terms of environmental management strengths, the sub-division has no staff, no experience and no resources. Earlier, under an African Development Bank (AfDB) funded training program, one senior PPESA (non-environmental) staff received classroom training in environmental audits. While this is useful, in no way, it meets the environmental audits, liability and compliance requirements of what lies ahead. Obviously, this subdivision, a major player under the proposed privatization needs considerable multi-dimensional strengthening. To highlight, these needs are also graphically depicted in *Figure 2: PPESA Institutional Strengthening for Post-privatization.* It must be noted that meeting PPESA's proposed requirements also involves time-consuming consensus building and participatory development processes. Thus, a timely action is crucial. This is especially important since it is a "start-up" situation requiring new sets of institutional roles, responsibilities and relationships. These may have to be established and formalized. Since 155 PEs are spread across Ethiopia, this process may also require establishment and/or strengthening of a few regional PPESA offices. Such offices would be needed to effectively relate to independent regional environmental offices of FEPA in matters relating to environmental compliance requirement of post-privatized PEs. Ironically, even these regional environmental offices are in rudimentary stages of development.

The risk of not doing or delaying infusion of much needed inputs to PPESA, FEPA and for that matter other relevant agencies as well have the potential of derailing or significantly delaying sustainable privatization including post-privatization proposed progress. Given this situation, it is important for PPESA to recognize the important EHS dimensions of collective and individual privatization transactions. All these and related issues must be timely and diligently taken into account during preparation and implementation of privatization process. Furthermore, agencies must implement compliance and post-privatization monitoring, implement and enforce applicable laws and regulations on enterprises' new owners. Also the new investors or owners must adhere to the highest standards of safe and sound operation for protection of not only the environment, but also the employees and the people in communities where privatized enterprises are located and do business. Compliance with Ethiopian EHS legislation, rules, regulations and standards as well as applicable international obligations would need to be assured and enforced. Again this will require an adequate technical and management capacity on the part of the PPESA as well as other agencies.

In terms of institutional aspects, it is full integration of four critical aspects of an institutional management: legal framework, training, review and communication that will help to ensure environmental and social sustainability of privatization of public enterprises (and also new owners or investors) themselves. Thus, the privatization process must define respective roles and responsibilities of all partners.

Proposed key PPESA institutional strengthening requirements highlighted in Figure 3: *PPESA: Institutional Strengthening for Post-Privatization.* These are briefly elaborated as follows.

- **Training**

Work experience and efficiency can be improved with new ideas and technologies. In Ethiopia, trained manpower is in seriously short supply. To help put the process of privatization on sustainable path, capacity building and training needs must be fully defined and met. Each interacting agency such as PPESA, Ministry of Labor and Social Affairs (MLSA) and the Ministry of Health (MoH) must develop strategic plan to strengthen all

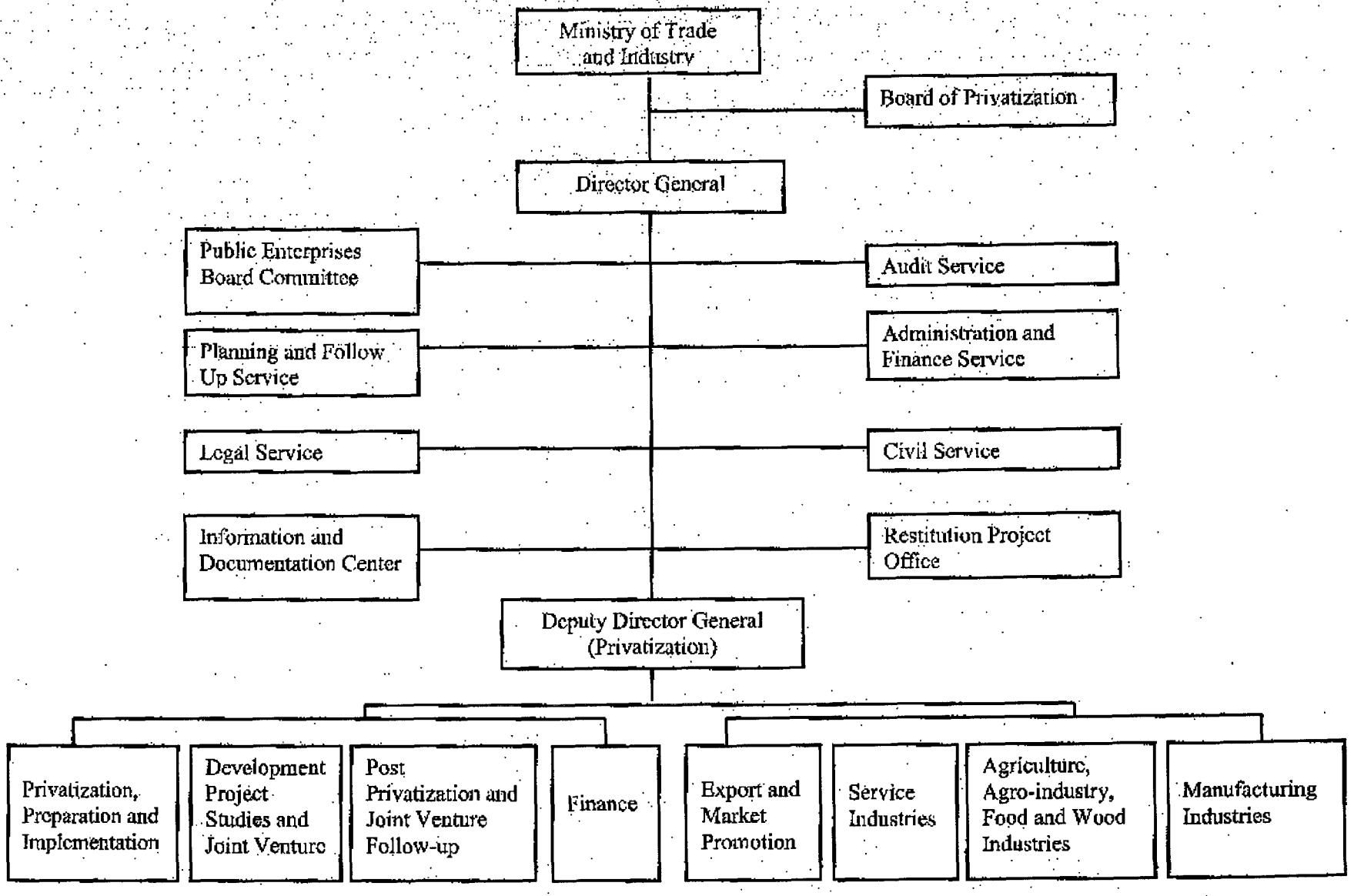


Figure No. 2 ORGANIZATIONAL CHART: PPESA-THE PRIVATIZATION AND PUBLIC ENTERPRISES SUPERVISING AUTHORITY

elements of each's capacity building requirements. In addition, a regular review can help assure compliance. Timely and effective communications and information disclosure mechanisms will allow every stakeholder, new owners or investors (NOI), affected or interested party to learn about the EHS requirements and of the respective changes quickly and accurately.

In addition, training may be needed for PE's management staff. While Production workers are likely to find alternate employment, if necessary the displaced managers may find relocation difficult. Under the privatized world of PEs retrenchment and loss of employment are norms.

The cost of the proposed training, given its diversity and wide dimensions cannot be accurately estimated. However, on a limited basis, under a pilot program selectively implemented, an estimated budget of $50,000 is proposed.

Many cases of non-compliance of the EHSs regulatory framework have their origin in poor or non-existent training, inadequate institutional and technical capabilities in public and private sectors. Training PPESA staff (and also its clients) in implementing various requirements will help develop the culture of compliance, and specific environmental and managerial skills and capacity.

New employees need training and seasoned employees improve with retraining. Experience has shown that even most experienced employees are never done learning.

This training is available in Africa in countries such as South Africa or Asia-India , Thailand etc., or in the West in the USA or Europe.

- **Staffing**

Currently, PPESA has a total staff of 101 against its planned strength of 214. Given the potential dimensions of its responsibilities the staff strengths need an urgent view not only for post-privatization's environmental needs but also for other areas, as well.

To manage its potential environmental responsibilities, it is recommended that as a start, under — an environmental sub unit consisting of a senior environmental engineer a junior environmental scientist, both supported by 1-2 administration stuff is established. Qualifications for the senior environmental engineer include B.Sc. degree in environmental engineering, chemical engineering with 10^+ years of experience preferably in industrial environment or an M.Sc. degree in the above fields 25^+ years of experience.

Likewise the junior environmental scientist should possess a B.Sc. degree in chemistry biology or environmental sciences with 2-3 years of relevant experience. Each of these positions must be (competitively) filled within the guidelines of PPESA. Annual budget for the proposed three positions: Senior environmental engineer ((45,000), junior environmental scientist (Birr 30,000) and support staff (Birr 20,000) is estimated at Birr 95,000, equivalent to US $ 11,000).

- **Establish a Social Impact Unit**

During field visit while many workers are aware of the forthcoming privatization and generally endorse it, equal number appeared to be against it. It is important to sensitize all

workers on how privatization would affect them and what their rights and obligations are. PPESA currently does not have a sensitization team or unit to achieve these ends. In African countries such as Ghana and Zambia where this has been incorporated, privatization process has moved relatively smoothly.

Based on discussions with a few PPESA staff, estimated costs for the first year for this unit are projected at $20,000.

- **IT Infrastructure**

Given the magnitude of PPESA task that lies ahead, the agency is also equipped in terms of Information Technology (IT) infrastructure. Currently, a 3-member unit supports its needs. As PE privatization moves ahead, the agency will need to develop databases, networks and other relevant software and hardware infrastructure. Included are computers, printers specialized software and workstations.

Based on discussions with some of the staff and on a broad review of the situation, at the start, there is an urgent need to hire 2 mid level professionals (annual estimated total cost Birr 40,000) and install additional software and hardware, at an estimated cost of Birr 50,000.

Budgetary Resources

Currently, $3M may be potentially available, lying unspent from the African Development Bank's earlier funding for privatization activities. Subject to availability, the amount can provide budgetary support for PPESA's strengthening. In addition, approximately 1.1M Birr from leftover GTZ founding for IT resources, in addition to domestic founding resources may also be available.

In addition, the World Bank's Environmental Safeguard and other related procedures and policies also become binding on every loan agreement including the current one. It is important that PPESA has the authority to cancel any privatization transaction if the new owners or investors do is comply with the provisions of privatization process. In developing countries such as India, where this has been done, privatization of PEs has preceded well.

To do the environmental pre-audits, it was also considered important to have good knowledge of the operations and processes to be reviewed, the relevant regulations that apply to a given facility or industry, and acceptable auditing practices such as the level of auditing that is required under the bank's TOR. This was accomplished through review of published science and discussions with the bank's appropriate staff.

The current study, an environmental a pre-audit has been carried out to assess and to rank prioritize the 129 PEs with respect to those requiring comprehensive (full) audit, partial audit and no audit. Also, it is likely that many privatization transaction for PEs may not require a full blown environmental audit because these PEs are considered unlikely to have caused or will cause significant environmental health and safety (EHS) impacts or consequences. At the same time, such a decision may require reassessment, closer to the time of the transaction. However, some PEs are situated in a "red flag" sector or industry such as sugar and tanning, **(see section 4.0)** that is likely to have significant EHS impacts, which are sensitive, diverse or unprecedented, and have potential past, current and/or future impacts, risks and liabilities.

Some of the PEs based on the evaluation and ranking criteria (section 6.0) have been classified as candidates for Partial Audits (PA) since the magnitude of their past, current and future liabilities is considered relatively less severe. Usually, the EHS impacts from such PEs are site-specific, few of them irreversible and in most cases, mitigation and compliance measures can be designed based on an environmental assessment (EA).

The objective of this pre-audit is to develop a prioritized list of concerns related to past and on-going activities in the privatization candidates. In addition, a review of the capacity of the agency(s) in-charge of the environment to monitor and enforce existing regulations as well as the capacity to execute remediation plans, at appropriate time.

APPENDIX A

1. Environmental Pre-audit Information of 155 PEs

1. 1 Abonje Agriculture Development Enterprises — Agriculture

The enterprise was established in 1985 as a pilot settlement program at large. However, gradually it turned to cultivate cotton as its main activity. Currently, it is also engaged in processing cotton and cottonseeds.

Main environmental problems for the agricultural area is pollution of garbaged (stored) chemicals, mostly (Pesticides). The quantity estimated is large, stored for over 15 years and is of unknown composition. The containers are badly damaged and leaking. In the area, one can smell fumes. Pesticides by their very chemical composition are toxic. Degraded, stored pesticides, over time generally become more toxic. The situation poses dangerous EHS risks. It needs immediate attention. On an urgent, if not on an emergency basis, the management should contact the FEPA and seek advice and action for removal and environmental disposal of these chemicals and pesticides. In the meantime, workers entering the area must wear personal protective equipment (PPE) and take other appropriate measures.

Based on the review of the situation, knowledge of pesticides, and using the rating criteria, a full audit is recommended. Until this is done, all protective measures must be taken to contain the damage. Reports have been submitted several times to the concerned authorities. During spraying, all safety precautions are taken.

The problem is part of general issue regarded to agricultural chemicals stored and kept endlessly causing health impairment.

1. 2 Agricultural Equipment and Technical Service Enterprises — Agriculture

This facility was established in 1978. At present, it has 548 employees. Its main business activity involves procurement and distribution of different type of agricultural machinery and associated spare parts and procurement of agricultural chemicals.

In addition, maintenance and repair services for agricultural and construction machinery, land development services such as cleaning and leveling roads, constructing farm roads and irrigation canals and renting construction machines. Technical advise and training on handling and operating different types of Agricultural and construction machinery is also provided by the enterprise.

During visit, oil spills were observed in almost all working environment. Spilled oil is cleaned by the use of saw dust and the wastes stored on premises. Company discharges the effluent into a near sedimentation tank where filtration is carried out. The residues remains in the tank and the wastewater are discharged into a nearly creek and also surrounding land. The sedimentary tanks need to be cleaned.

In addition, toxic and hazardous chemicals are stored on the premises. Many containers are old, rusting, and have leakage. The enterprise, in collaboration with Ministry of Environment has been able to remove some of them. However, four large containers still remain.

Asbestos sheets are used for roof covering. These sheets are old and crumbling, offering a pouential health hazards through air-borne asbestos.

At this time, a partial environmental audit is required. Based on the findings, a full audit may be required. This is because the environmental issue mentioned above needs a long-term assessment. The management was advised that it is important to handle environmental problem as soon as they arise in the working environment.

1.3 Agricultural Input Supply Enterprises — Agriculture

The enterprise is not covered because it is no more under PPESA.

1.4 Agricultural Mechanization Service Enterprise — Agriculture

Established in 1987 with the objective of that time, to render agricultural mechanization and related services to the peasantry and agricultural producers cooperatives. Again re-established as an enterprise in 2004 with improved objectives to render: mechanization services, maintenance of machinery, implements and transportation services on rental bases.

Tractors, combine harvesters, implements low-bed trucks are main inputs to perform the above mentioned services adequately. On-site maintenance is given in small units located in different regions where services are rendered.

According to the discussing made with the concerned personnel, the enterprise does not involve in any technical activity such as processing, manufacturing and the like. Operators on site-duty are provided with protective equipment where needed. Based on the assessment made during the visit, the facility requires no further environmental audit.

1.5 Arsi Agriculture Development Enterprise — Agriculture

Arsi Agricultural Development Enterprises is a rain fed agricultural enterprise. The enterprise, with its head office in Assella, 175 Km from Addis Ababa, was established in 1980. The major produce of the enterprise is wheat. Chemical fertilizers, pesticides herbicides are used annually by the enterprise. This include urea, up to 5,000 quintals, Dap over 10,000 quintals, pesticides about 5,000 liters, and herbicides about 10,000 liters. Since many of these are traded namely, their chemical composition could not be ascertained. The management was advised to request the suppliers to list key ingredients on the labels. Arsi Agricultural Development enterprise has 1665 employees.

The amount of usage of various chemicals is however on the lower side of the required range. It is likely that the chemicals are totally absorbed by the soil. Besides, spraying of chemicals takes place well before the rain starts. The enterprise has been spraying chemicals from the

air. It is now shifting to manual application. Chemicals with expired application dates were re-exported for final disposal. Underground storage of fuel at the facility is checked by the Shell Oil Company on a regular basis. All workers involved in various activities related to chemicals (mixing, spraying etc) are provided with protective devices and the enterprise enforces their usage.

In view of the controlled amount of usage and application of various chemicals by the enterprise, potential run off of chemicals to the nearby river may not be occurred.

The measure taken by the enterprises to shift from aerial application of chemicals to ground application is commendable activity. Summing up, it is recommended that an analysis of the rivers in the region (Webe Shebelle and Melka Wakena rivers) be undertaken.

Nevertheless, given the strong potential of adverse EHS impacts, a full audit is recommended.

1.6 Awassa Agricultural Development Enterprise — Agriculture

The enterprise is located in Awassa town, some 270 km south of Addis Ababa. It was established in 1960 and re-established, with major changes in 1993. The enterprise is an agro-industry which owns an oil factory (not operational at the moment), Sisal processing factory which currently operates at 30% capacity, and 4100 hectares of rain fed agricultural farm producing mainly maize, apricots, beans, Soya beans, sun flower and sisal.

The enterprise uses insecticides, herbicide and chemical fertilizers for its agricultural production. The enterprise uses average management practices for insecticides and fertilizers, and overall, it is weak in many aspects. For instance, bags and sacks where possible are not returned for refilling.

Based on the above and overall nature of the operation, a full audit is recommended.

1.7 Bale Agricultural Development Enterprise — Agriculture

The enterprise was established in 1977, to promote mechanization system for crop production on state farms. The enterprise grows wheat, barley, jaba bean, and other types of crops. To produce these crops, tractors, harvesters, combiners and other mechanical implements are used. Pesticides, herbicides, and fungicides are also used to grow and protect these crops from pests.

As in other agricultural enterprises, Bale also has stored chemicals, posing potential EHS hazards. According to briefings given in the back office during the visit, the enterprise is making every effort including contacting concerned health offices. However, to-date, no response for action has been obtained.

Disposal of empty containers must be given serious attention. Some workers indicated that they have been using the empty barrels for storing water and as a container for food items. The problem of agricultural chemicals disposal seems to be a national issue. Improper use of agro-chemicals-fertilizers, pesticides, herbicides, etc., poses serious environmental, safety and health risks. The situation requires immediate attention for proper use and safe disposal.

Workers must be provided with PPE. The enterprise must also keep proper records and documentation.

Based on the criteria mentioned earlier, a full audit is recommended.

1.8 Coffee Plantation and Development Enterprise — Agriculture

The enterprise was established in 1980, after nationalization of different small farms belonged to individuals in different localities. There are nine farms under the enterprise engaged in producing washed and sun dried coffee, cereals, diversification, and pure natural honey. It has a total of 21,232 employees.

In the enterprise pesticides and herbicides are used for cereals only. Pesticide like Galy phosphate and Granoxin are mostly used and they are not toxic. Workers are given masks and gloves and they are wearing it because of the strict control of the management. In case of herbicides, phrosoxil and copper belt are mostly used and due to their organic nature they are not toxic and harmful to health.

Oil spillage in the garage is common. The Ethiopian Environment authority personnel have visited the farms and given their findings. The reports of the authority show no toxic and hazardous substances found.

Regarding the wastewater, the enterprise has no wastewater generated. In the process of washing coffee, solid coffee skin comes out and they are using it as organic fertilizer, while the wastewater is disposed to the nearby river. So far no claim or complaint has come from individuals or other authorities.

Based on the situation existing, and the organic nature of the materials used, the environmental audit required is the level of partial audit.

1.9 Coffee Processing and Warehouse Enterprise — Agriculture

This operation basically consists of coffee processing, weighbridge services, and parking for large number of trucks. The entire operation employs 361 permanent (55% women) and 1244 temporary staff of which 95% are women.

Various processes include pre-cleaning, separation, grading, manual sorting and packaging. The total production capacity is 31,000 Tons. The workers are well aware of the fourth coming privatization. Since now no authority concerning environment, health and safety issues has visited the enterprises. No hazardous problem except dust in which the effect has not been identified.

Regarding the effluent, there is no treatment. Untreated wastewater is discharged through concrete pipes to the city drainage. Based on the existing situation, the environmental audit required is the level of partial audit.

4.10 Dairy Development Enterprise — Agriculture

The enterprise was established in 1947 and it has 360 employees. The main products are pasteurized milk, table and cooking fresh butter, formajo (cheese), local soft cheese, yogurt and cream.

There is no hazardous chemical in use except caustic soda for cleaning purpose. Oil spillage all over the garage and boiler room and also solid wastes are dumped in the compound. Workers are provided with the necessary protective equipment and they wear it, due to restless control of the management. Wastewater is disposed to the municipal drainage and no claim has come from any individual or concerned authorities.

Since the enterprise has no hazardous situations, the environmental audit is enough at pre audit level.

4.11 Ethiopian Fruit and Vegetable Marketing Share Company — Agriculture

The Ethiopian Fruit and Vegetable Marketing Enterprise (Et fruit) was established in 1980. It is a major domestic distributor and leading exporter of fresh fruit, vegetable, cut flowers and processed horticultural products in Ethiopia. The enterprise has 263 employees.

The major suppliers of fresh fruits and processed products in Ethiopia are however big public enterprises and private farms.

Oil spills around the petrol station were observed, primarily due to luck of cleaning and good housekeeping. The facility has a fuel tank with a capacity of 20,000 liters on the ground. The enterprise discharges the effluents into city drainage without any treatment.

In view of the poor housekeeping, the presence of oil spills in a number of the facility's wastewater, a partial audit is recommended.

4.12 Horticulture Enterprise — Agriculture

The enterprise is mainly engaged in growing fruits and vegetables. It has three farming areas at Zeway, Gebe and Yerere Gota in Ethiopia.

Regarding environmental issues, fertilizers, pesticides, insecticides, and fungicides are used in varying quantities. Most of these chemicals are registered and are organic, potentially non toxic. Workers are provided with necessary PPE and they wear it. During the visit, it was mentioned to the team that no asbestos material and wastewater discharge occur in the growing areas. Obsolete chemicals were disposed off by ministry of farming.

The enterprise is certified by Europe-GAP, for Good Agricultural Practice from 2004-2007.

The environment audit required is a level of partial audit.

1.13 Middle Awash Agriculture Development Enterprise — Agriculture

Middle Awash Agricultural Development Enterprise, located in the middle of Awash Valley, 265 Km from Addis Ababa, was established in 1980. The enterprise with a land holding of 6,000 ha in three farms is primarily engaged in cotton farming. The enterprise also operates a ginnery. Middle Awash has storage tanks for diesel and petrol (capacity: 30,000 liters each). The enterprise annually consumes 12,025 liters of chemicals, mainly pesticides. Spraying of chemicals is carried out by aircraft. Drains, which run off to Awash River, are thus found to be polluted. Sulfuric acid, although in diluted form, is used in seed preparation.

Used oil (from tractors) of about 200 barrels per year is dumped on the ground for the purpose of soaking the dust. Cotton dust and particles from the ginnery are discharged into the air.

Walls of offices and residential houses are constructed from asbestos.

The environmental issues raised above warrant a partial audit.

1.14 Setten Omo Agricultural Development Enterprises — Agriculture

There are three farms, which are administered under this enterprise. These are Arbaminch agricultural development established in 1961, Sile Agricultural development and Abaya agricultural development both established in 1972. The total land holding of the three farms reaches 3,479 hectares, out of which Arbaminch has 800, Sile 1,500 while that of Abaya is 1,179 hectares. The main crop is cotton, while corn and banana are also cultivated. The enterprise employs a total of 1,135 permanent workers out of which 30 are assessors or pest scouts 50 sprayers and 3 are crop protection heads.

Insecticides such as endosulphan, carbosulphan, talstar, mitigan or decis are sprayed manually or by air depending on the type of insect noticed by the pest scouts mainly on cotton plantation. Normally endosulphan is sprayed by aircraft up to 3-4 rounds per season. The workers who are in contact with these chemicals are provided with protective devices like goggles, masks, gloves and boots but at least 2-3 workers are found infected (contaminated) during every year medical check-ups. There is also a possibility of spraying the chemicals during air spray, outside the required area, which could be hazardous to various receptors.

Based on the assessment and discussions made during the visit, the facility qualifies for partial audit.

1.15 Tendaho Agricultural Development Share Company — Agriculture

Tendaho Agricultural Development Share Company was initially established in 1972 at a location along the bank of Awash River, 580 Km from Addis Ababa. The company, which has a total land holding of 7,452 ha, produces raw cotton, lint cotton, cottonseed, delineated seed and linter cotton. Tendaho also operates a ginning factory. The company uses 62,000 quintals of pesticides (endosulfan, pyrethoid, carbonate, organic phosphate decametrin, rupforezon). The company stores diesel, petrol and aviation gas in underground and over ground storage tanks of 500,000 liter, 20,000 liter, and 20,000 liter capacities respectively.

Pesticide, which is sprayed by aircraft, could pollute the drains that run off to the river. Wastewater from pesticides preparation and seeds preparation (which involves sulfuric acid-though diluted-and a chemical called azrosen) areas is allowed to settle in a pond from where it evaporates.

Used oil (about 40,000 liters/annum) is collected in barrels and dumped on the ground for the purpose of soaking the dust. The exhaust duct of the ginnery emits some dust and other particles. Roofing of old houses are constructed from asbestos.

All the issues raised above indicate that a partial audit needs to be carried out.

1.16 Upper Awash Agro Industry Enterprise — Agriculture

Upper Awash Agro industry enterprise, established in 1980, is stretched over the upper bank of Awash River. With its head office in Arsi Zone, 174 Km to the east of Addis Ababa, the enterprise operates four farms (Tibila, Merti Jeju, Nura Era and Awara Melka) and a fruit and vegetable processing plant (Merti). The total land holding of the enterprise is 7,497 ha. The enterprise annually produces 78,805 tons of various types of fruits, vegetables, cereals, cotton, seeds and factory products. Fruits and vegetables make up about 80% of the enterprise's output. The enterprise employs 1,500 people.

Upper Awash Agro-industry uses a number of chemicals for both its farming and factory processing operations some of the chemicals in use are: Diazol 60 EC (11,230 l/year), kocide 101 (15,100 kg/year), mancozeb (Helcozb) 80% wp (15,140 kg/year), aluminum phosphide 58.8% (580 kg) Both tractor mounted and manual methods of chemical spraying are employed. Caustic soda (about 1500 liters/annum of 10% concentration, which is further diluted to 2.5%) is used for cleaning purpose in the processing factory. Wastewater, which includes caustic soda, is discharged untreated. Management claims that caustic soda is so diluted that it will not be hazardous. There are some furnace oil spills around the storage tanks. Asbestos roofing is used on some houses. The enterprise is replacing these with some other material. The enterprise is Euro GAP (Good Agricultural Practice) certified.

Nevertheless, at least a partial audit needs to be undertaken.

1.17 National Veterinary Institute — Veterinary

The institute is not covered because it is no more under PPESA.

1.18 Commercial Bank of Ethiopia — Banking

The bank is not to be covered according to PPESA.

1.19 Construction and Business Bank Share Company — Banking

The bank is not to be covered according to PPESA.

1.20 Ethiopian Development Bank — Banking

The bank is not to be covered according to PPESA.

1.21 Ethiopian Insurance Enterprise — Insurance

The enterprise is not to be covered according to PPESA.

1.22 Ambo Mineral Water Factory — Beverage

The company was established in 1930. It has a total of 776 employees. The main products are mineral water and carbon dioxide (Co_2). The process includes de-packing, bottle washing, inspecting, filling, crowning and capping, labeling and packing.

Different types of chemicals are used for Co_2 gas water-cooling, for water and Co_2 gas treatments, for water softening and for labeling. During the visit, no hazardous conditions were observed in the handling and use of various chemicals. The Ministry of Labor and the Ethiopians Environmental Protection Authority personnel have occasionally visited the company and given their recommendation in their respecting areas. The company provides the necessary protective equipment according to the recommendations and provisions of the collective worker agreement. Oil spillages were observed around the furnace and petrol tankers and the underground tanker has never been checked for leakage. Asbestos material in friable form exists in the boiler room for heat insulation purposes

The environmental audit required is the level of pre-audit because of the asbestos material oil spillage and underground tanker situation.

1.23 Assela Malt Factory — Beverage

Assela Malt Factory is located about 167 km from Addis Ababa. The factory was established in 1984. The factory is the only one of its kind in the country. It produces 150,000 quintals/year of malt barley for breweries. The factory employs 211 workers.

About 400 m^3 of wastewater is generated daily in the process of washing the malt barley. The wastewater (steep liquor) with, skimming or floating grains is discharged to a near-by Kulumsa River. The wastewater upon decay generates offensive odor. It has been the cause of major complaints by farmers in the vicinity. A study undertaken has shown that phosphorous could be mixed with fresh water and could be used for irrigation purpose. The factory uses freon gas (less than 1 kg/year) for cooling silos. A separator is installed as suggested by Shell Oil Company to prevent leaking or spilling oil from being discharged into the river along with water.

The spent liquor (apart from its offensive odor) is believed to be an organic waste. The impact of continuous use of freon gas needs review. Also, the effectiveness of the separator may also needs an environmental review.

A partial environmental audit of these areas is therefore recommended.

1.24 Awash Winery Share Company — Beverage

Awash Wine Share Company was established in 1943. The Company produces a range of alcoholic products for domestic use and also for exports. Some of the brand names include Awash Crystal, Axumite and Amba and also Aperitif Wines Kidlike and Vermouth as well as 'Grappa' a distillate from wine and Vinegar. Its vineyards are located in the central plateau and also along the Awash River. The firm has been the recipient of European awards for its products.

Based on discussions with factory personnel, and site visit, there appears to be minimum environmental impacts. For instance, broken bottles are properly disposed and the wastewater seems to have acceptable levels of contaminants.

No further environmental audit is required for this facility.

1.25 Babile Mineral Water Factory — Beverage

Babile mineral water factory is located in Harar town, 550 km from Addis Ababa. It was established in 1945. The factory employs 193 people to produce carbonated mineral water (about 7 million bottles annually). In addition to large quantities of water, some of the major raw materials used include caustic soda (annual consumption: 7,000-10,000 kg), everite (annual consumption: 200-250 kg), hydrochloric acid, antifoam and rust remover chemicals.

Generation of flue gas by the boiler (a very old one, with incomplete combustion) poses potential health risks. It has also been the subject of serious complaints from area residents. Wastewater, which comprises of a few chemicals including caustic soda and everite is discharged into the surrounding area untreated. The factory uses asbestos for steam pipeline insulation. Some of this insulation is crumbling and old and poses risks. Also, there are furnace oil spills around the boiler tank area. Furnace oil is stored in an underground storage tank of 20,000 liters capacity.

The issues of boiler flue gas generation and the discharge of untreated wastewater need some consideration.

A partial audit is thus recommended.

1.26 Bedele Brewery Share Company — Beverage

Bedele Brewery is located in Oromia Region, Illubabor Zone, in Bedele town, 480 Km south west of Addis Ababa. It was established in 1993, and has a total of 789 employees. The factory presently produces two types of European based lager beer 125 Premium and 135 Choice Bedele Special Beer. The production capacity of the factory in a two-shifts operation is 100,000 litres or 300,000 bottles of beer per day. The main raw material is malt from Assela malt factory.

There was no noise, asbestos material and chemical hazards observed. Most of the chemicals are food grade chemicals. Oil spillage has been observed in the garage and around the

furnace tanker area. There are two tankers with a capacity of 425 m3 built in open land. There are also underground petrol tankers, which have been built with the factory and have never been checked for leakage. The factory has technically advanced biological waste treatment plant. The sludge is damped in the nearby land, while the treated wastewater is discharged in the nearby river. It was disclosed that the pH is 7. The treatment plant needs renovation and the shortage of chemicals was observed.

The factory has been visited by Ethiopian Environment Authority personnel and who have suggested oxidation pond for further treatment of wastewater. Regarding solid waste, there is a spent grain, which is used for animal food, and there is also a huge amount of piles of used bottles, which the factory could not find any means to avoid.

Due to the existing situation, the environmental issue required is a level of partial audit.

1.27 Harar Brewery Share Company — Beverage

The company is located in Harar City, 550 km east of Addis Ababa. The Brewery was established in 1984. The company produces about 200,000 hectoliter of beer annually from barley, water, malt, hops, and yeast. Chemical used by the company include hydrochloric acid (164,817 kg/annum), filter aids (food grade), caustic soda, and sodium hypochlorite.

Hydrochloric acid used for water treatment is discharged after neutralization. All other wastes are also treated in on-site waste treatment plant. Sludge cake is disposed off in the countryside. Although the cake burns the growing plants at times, the sludge cake is still used as a fertilizer. Furnace oil is also stored in two over ground storage tanks (total capacity of 900,000 liters). There are some oil spills in this and the workshop areas. The company is planning to install a collector to prevent oil spills.

The storage of hydrochloric acid is in the open areas where it is exposed to the scorching heat of the sun, where the oil is degraded. To this end, the company is planning to build a warehouse.

Awareness of safety and occupational hazards and the need to put in place safe EHS measures is high priority in management members. A management member (at service level) is responsible for safety. The company is also working towards HACCP (Hazard Analysis Critical Control Point) certification. The waste treatment plant is 20 years old so its operation effectiveness and efficiency may thus need to be assessed.
Review of the situation indicates the need for a partial audit.

1.28 Meta Brewery Share Company — Beverage

Meta Brewery was established in 1965. It produces lager and draft beer, using mostly locally produced malted barley. The large brewery's annual production is 38.6M liters or 386,000 hectoliters. Most of the production is consumed domestically.

As in any brewery of Meta Abo's size, large number of chemicals along with other inputs is used. A number of these are described under Section 4.2.3. In addition, the specific issues related to Meta Abo include:

1. Improper disposal of broken bottles and crown corks.
2. Non-functioning wastewater treatment plant. Combined with this situation is the existence of poor operational procedures to control the quantity of wastewater generated and to minimize the pollution potential.
3. Ammonia-compression room has leakage. The situation is creating unhygienic conditions and needs immediate attention including assessment of the cause of the leakage.
4. During the site visit, a thick layer of dust was noticed on a number of pumps in the bottle washing machine.

Based on the site visit, discussions with the officials, the industry knowledge, and use of rating criteria a full environmental audit for the facility is recommended.

1.29 National Alcohol and Liquor Factory — Beverage

The factory was established in 1920. In Ethiopia, the factory is the sole producer of pure and denatured alcohol for use as raw material for liquors, medicines, laboratory and clinical work, cosmetic production, and for the production of chemicals and plastics. In addition, the factory also produces and distributes a variety of high quality liquors. It has four branches: Maichew Liquor Factory, Sebeta Alcohol and Liquor Factory, Mekanissa Alcohol Distillery and Akaki Alcohol Distillery.

Key environmental issues at the plant include oil spills and old pipes, some covered with cracked and crumbling asbestos, and large quantities of broken bottles.

Given this situation, the facility is recommended for an environmental pre-audit.

1.30 Muger Cement Factory — Cement

The enterprise is located in Muger Village, 110 km northwest of Addis Ababa. Access to facility requires travel over 100 Km of gravel roads. There are two production lines to produce Portland type of cement. The first line was established in 1985 while the second line started production in 1991. The enterprise employs over 800 permanent and 200-300 temporary workers. The raw materials used are limestone, clay, pumice and gypsum, the latter up to 1 million tons/year. The total production of Portland cement averages 600,000ton/year.

The working area around the raw material store, grinding and packing section is very dusty; the dust contains pumice, calcium carbonate and cement. Though the factory claims that the workers are provided with the necessary protective devices, some are seen working without it. The exhaust from the chimney is full of particles of calcium carbonate, which should have been prevented by electrostatic precipitation. During the visit we were told that there is a serious complaint from the surrounding residents about the dust coming from the factory to their area.

As this situation has the potential to create environmental pollution, it can be concluded that the facility qualifies for a partial audit.

Unfortunately, after the visit, we learnt that the above facility is a state monopoly and is not a privatization candidate.

1.31 Adami Tulu Pesticide Processing Share Company — Chemical

The company was established in 1998. It started production of pesticides and insecticides since 1998. It is located about 170 km of South of Addis Ababa. The factory secures its raw materials and produces the final product upon receipt of an order from its customers, i.e., Ministry of Health and different farms.

The active and filler of the under mentioned raw materials are imported and subsequently formulated according to the Standards and regulations stated by Food and Agricultural Organization (FAO) and the World Health Organization (WHO).

Output of the factory includes (a) Liquid form: Endosulfan with different concentration, Diazinon, Dimethoate, Fenthrothin, and (b) Powder form: Malathion , Endosulfan.

The firm uses international standards for its manufacturing process. For example all products prior to sale are certified by the concerned local and international authorities. Required protective devices are provided to the workers, who are required to use it. No signs of EHS violations were observed. Nevertheless, given the toxic nature of its products, a partial audit is recommended. This will enable a longer and a better look at the enterprise.

The outcome may require a full audit.

1.32 Addis Ababa Bottle and Glass Share Company — Chemical

The company is the only glass manufacturing plant in Ethiopia. It was established in 1973. The factory is situated in a suburb of Addis Ababa, some 8.5 km, the road to Ambo. The production capacity of the plant is 20 tons/day of container glasses. The number of employees varies between 200 and 250 including temporary workers.

The raw materials used for the production of bottles and tumblers include Silica sand, lime stone, marble, soda ash, and scrap glass. The quality and appropriateness of each of the materials and the batch preparation undergo serious check-ups on a continuous basis by qualified technicians in the laboratory specially organized for this purpose.

Additives like de-colorants and colorants are also used especially for the production of amber bottles, which are produced by the reaction of the raw material with sodium nitrate and addition of masking chemicals like selenium oxide and cobalt oxide.

During the process, raw material marble and silica are washed for white bottles production, in order to remove any coloring material like iron. The water washings are collected in tank and

the over flow is reused. The solid matter is removed from the tank and collected in the factory compound. Therefore, there is no hazardous liquid discharged from the factory.

The exhaust gas, coming out from the melting zone according to the plant personnel, may contain sulfur dioxide (SO_2) gas, the amount of which is unknown.

The workers are provided with nose masks to protect them from the dust, which occurs during the drying of the raw material. Most workers are told to use these masks, given their environmental and health importance.

Currently the company produces 30 tones of bottles and tumblers/day. It is uses electrical heating system. The furnace area is about $16m^2$. After the implementation of this project, it is believed that the company shall fully satisfy the market both in quality and quantity.

Based on the pre-audit this facility is considered to offer low EHS risks. It risks qualifies it as a partial audit candidate.

1.33 Addis Ababa Foam and Plastic Factory — Chemical

The factory is closed due to fire.

1.34 Alyd Resin Share Company — Chemical

The factory was established in 1993. It has a total of 110 employees, the company mainly engaged in producing a variety of resins in liquid form. These resins are primarily used as a binder for paints.

Raw materials annually used include linseed/Soya bean oil 1460 Kg, penetry unitol 325 Kg, pentalic anhydride 540 kg, malefic anhydride 25 Kg, solvent kerosene 2,060 liters, and xylene 80 Kg/batch.

At the factory, the resin is filled in barrels, for distribution to the paint factories. The main ingredient used is xylene. To reduce the EHS effects the company has prepared and submitted a project to chemical society. The effluent is discharged to a near-by-open land without any form of treatment.

Using the criteria used for other PEs, a partial environment audit is suggested.

1.35 Awash Melkassa Aluminum Sulfate and Sulfuric Acid — Chemical

The factory is located 115 km from Addis Ababa on the way to Assela. The Share Company was established in 1995. The product range and production capacity of the company is as follows: Sulfuric acid (98% $\pm$ 0.5 wt) 17,000 tpa, Alum (25% free SO_3) 5,000 tpa, Aluminum sulfate (17% Al_2O_3) 13,600 tpa.

The major raw materials used are Kaolin (4,000 tpa) and Sulfur (1,600 tpa), and the auxiliary materials are Hydrated lime (20 tpa), Diatomaceous earth (1tpa), and aluminum hydroxide (300 tpa). The company currently has 230 employees.

The company's operation involves use and handling of several hazardous chemicals and gases such as sulfuric acid, sulfur dioxide and sulfur. Safety systems and apparatus currently used seem to be commensurate with the high level of care and precautions needed. For instance, there are fire alarms and fire blankets made available to workers. Also, fire hydrants are at appropriate locations. Silica sand, which is a by-product of the process, is an environmental - friendly waste. All other waste material is treated by waste treatment system using a neutralizing pit etc. before disposal. Air pollution is also checked by instruments. Also, there is a separate department (at top management level) responsible for safety.

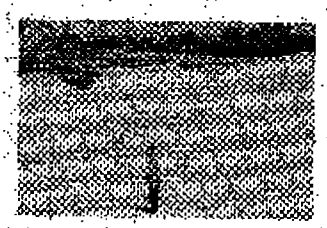
In as much as the company is prone to hazardous incidents, safety precautions and other measures during the visit are seen everywhere including in the design of the plant, organizational structure and good management and worker attitude. In spite of this, given the nature of the industry and use of a variety of potentially hazardous chemicals, it would be useful to give a closer look.

A partial audit, based on the criteria mentioned for other PEs is recommended.

1.36 Caustic Soda Share Company — Chemical

Caustic Soda factory is located about 160 Km South of Addis Ababa. The company was established in 1995. It produces caustic soda for the local Industries such as Textile, Soap, edible oil, Beverage, Pulp and paper, and others, etc. Although the factory has a designed capacity of 21,978 tons per annum, presently it is only working from 70-90-days/per year, around 1/4th of capacity and produces only about 3,500 tons of liquid caustic soda.

The factory uses limestone and trona (a mixture of Sodium carbonate, sodium bicarbonate and water) as raw materials to produce caustic soda of liquid 45.5 % concentration. Presently in addition to the caustic soda, the firm is also producing hydrated lime for water treatment.



Caustic Soda Share Company Discharge of Caustic Soda

The Trona amount of 1.7 is needed to produce one ton of 45.5% Caustic soda and 0.7 ton Lime for one ton of 45.5% Caustic soda, output reaches 3,500 tones of caustic soda per annum

Solid waste products mostly consisting of calcium carbonate, which is, dispersed and pumped to the un-protected open pond.

In addition to the above, all other factory washings and liquid materials are directed to the same pond. Since the pond is not protected and caustic soda is hazardous, special attention should be given to the waste disposal.

Although neutralization using HCL was assumed, at the beginning of the project, it was not successful till today. Secondly the liquid waste accumulated in the disposal pond has a possibility of percolation to the ground and contaminates the surrounding area.

A full audit of the facility is recommended.

1.37 Chura Gas and Chemical Factory — Chemical

This factory employees a staff of 450 and 25 temporary workers. This public enterprise primary manufactures acetylene, oxygen and sodium hypochlorinate (NaoCl). In addition, at another location, the firm produces shoe polish and floor wax.

The raw material used for the production of these products include calcium carbide (CaC_2) imported from China, mostly for acetylene production. The operation currently is profitable.

The factory produces calcium hydroxide as a by product of the operation. The small quantities of untreated wastewater are discharged into a near by creek. Representatives from the Federal Environmental Protection Authorities have visited the factory and advised on improvements.

However, no documentation was available at the time of the visit. A partial audit for the facility is recommended. This is based on the above visit, discussions with the factory officials, personal knowledge of the industry and the use of ranking criteria.

1.38 Nazareth Soap Factory — Chemical

This factory was established in 1978. It is mainly engaged in producing laundry soaps. It has 167 employees and produces 63000 tons per year. The main raw materials used are palm fatty acid and caustic soda.

At the factory, at the time of the visit, fumes were emanating. There is no hood or other exhaust systems to ventilate toxic vapors and protect workers. In the Boiler room and the surrounding area soil plume was observed. The furnace oil smell was emanating, and the workers are not aware of the dangers, nor are provided with the appropriate masks.

The factory accumulates the effluent in a tanker where the residues remain while the untreated effluents are discharged to the city drainage system. The factory is much disorganized. The floors were dirty, and slippery. In general the safety and health condition is poor.

A partial audit is needed to assess the situation.

1.39 Nitas Silk Paint Factory — Chemical

The factory was established in 1971. It has a total of 131 employees. Its main product includes water paint, oil paint, car paint and varnish.

The factory uses a number of chemical thinners. While their chemical composition was not available, most can be harmful to health when released in the air in heavy concentrations. During the visit a sharp irritating smell existed. There is no Health and Safety Officer at the facility. Visits from the Labor, Environment or other relevant Ethiopian Ministries are rare. Overall record keeping is also limited at the facility. Even though certain mechanical filtering is done to prevent solid particles, the effluent discharged from the factory has colors and smell of paints. These untreated effluents are discharged into the city's drainage system where it can be potentially damaging.

The facility needs a full environmental audit.

1-40 Reppi Soap Factory — Chemical

The factory is situated at 25 km West of Addis Ababa. It was established in 1974. Current production capacity of the factory is 2,252 tons of detergent products per annum in powder bar and liquid form.

The detergent and soap manufacturing processes use a number of chemicals. Included are dodecyl benzene sulphonic acid, sodium hydroxide, sodium silicate, sodium carboxymethyl cellulose, urea, tricholorisocyanuric acid, photin, triethanolamine, and perfume.

At the factory, different types of largo for industrial uses such as simple largo, medicated largo and viscous largo are produced by mixing dodecyl benzene sulphonic acid, Sodium Hydroxde, perfume and water in the liquid preparation. The effluent from the process goes to a small tank and overflows to an open drainage and ends up into a nearby steam.

Based on the visit and relevant discussions with the factory's officials the facility requires partial audit.

1-41 Addis Block Production Share Company — Construction

The company was established in 1980. It has 217 employees. The main activity of the company is to produce and sell wall blocks made from lime, gypsum and pumice. Other products manufactured include hollow concrete blocks. The major raw materials used include pazzolame cement 32,000 quintals/year, pumice 16,000 m^3/year, red ash 1500m^3 /year and fine gravel 1,500m^3/year.

A major environmental problem seems to be quantities of dust in the working area especially during the dry season. Thick layers of accumulated dust on the floor were noticed during the site visit. At the factory, there is no exhaust system. However, workers are provided with dust masks and working clothes. Oil spills around the garage were also noticed during the visit. This is primarily due to poor housekeeping.

Regarding the effluents, the company discharges its untreated wastewater into the city's drainage system.

The facility is recommended for a partial audit. As with others, this decision is based on the site visit, discussions with the company officials and use of ranking criteria.

1-42 Awash Construction Share Company — Construction

The Share Company could not be covered due to refusal of the management.

3.43 Arig Construction Share Company — Construction

The firm was established in 1969 with the objective of supporting the construction sector of the country. Being a general constructor the major activities are diversified and include construction of road, bridge, buildings, air port fields and the related infrastructure. Equipment used includes various types of heavy machinery, trucks, and other auxiliary equipment. Large and well-equipped workshop provides equipment maintenance support. In addition, a wood workshop support on site activities including for Mobile houses, furniture manufacture and other needs.

As regards environmental conditions, scrap of metal heaps and dumped empty barrels are seen every where. Workout machinery and heavy equipment are also scattered all over the compound. This requires further attention. Leaking oil barrels are also covered with oil. Also, spilled oil was seen all works areas dirty and oily.

In addition there are two fuel tanks placed underground. There is periodically the underground storage tank and the petrol pump is untidy. Oily areas can be seen. Bole quarry is also one unit to assist the efficiency of the enterprise by producing gravel. Excess and dust are main health problems when protective equipment is not used properly. There is no problem of wastewater disposal as such but heaps of dumped machinery and their parts; scraps off all kinds in the glass field should be given attention.

Based on the above findings, the PE qualifies for partial audit.

3.44 Blue Nile Construction Share Company — Construction

It is a construction company engaged in asphalt production, bridge and building works. It has a total of 140 employees, covering the head office and the firm's various project sites.

The main EHS issues include the generation of large quantities of dust especially around the crusher plant. However, after the environment protection agency visit and recommendations made, the problem has been reduced to a certain extent. This action includes use of a wet treatment method. Besides workers are now provided with dust masks. The company, it seems, has minimum environmental issues.

Based on the criteria used in this study, no further environmental audit is suggested.

3.45 Bricks Products Production Share Company — Construction

There are two factories operating under this enterprise. These are: (1) Burayoo bricks factory established in 1968, and (2) Ethio-bricks factory established in 1972. Both factories use red and white earth as feedstock from the surrounding area. Burayoo consumes about 2.32 M m^3/year while that of Ethio bricks consumes 2.27 M m^3. Burayoo bricks factory produces

9300-bricks/year and Ethio-bricks factory 9,100 bricks/year. There are 110 permanent and 120 temporary workers in each factory.

Both factories are using used oil for their burners. It was noticed during the visit that there is a lot of oil spillage on the ground, especially around the drums. The drums store used oil for the burners. The existing situation offers potential environmental hazards. At the plant, the production flow starts from grinding (crushing) of the earth after which a paste forms and molding of bricks follows.

Based on the visit and discussions with relevant personnel, this facility is classified as a candidate for partial environmental audit.

1.46 Building Materials and Supplies Enterprise — Construction

The enterprise is located in Addis Ababa. It was established in 1997, and re-established in 1994, with modified objectives. It is engaged in the production, procurement and supply of construction materials required for building and miscellaneous construction including renovation work. The major raw materials cement, gravel, pumice, red ash and river sand. The total consumption of which reaches 182 tons per year. The production capacity of the plant is 2.8 million pieces of blocks and 6,600 pieces of cement pipes of varying length per year.

The facility has insignificant quantities of discharges. No other environmental issues of any significance were observed.

Based on the criteria used for other PES, and hence no further environmental audit is required.

1.47 Cemental Materials and Supplies Enterprise — Construction

The enterprise comprises three factories; two are in Addis Ababa and third one is in Awasa, about 250 km away from Addis Ababa. There are 677 employees in the Enterprise. The enterprise has three factories

a. Addis Ababa Cemental Factory

The factory was established in 1957. The raw materials used are cement, river sand and gravel of different sizes and in various proportions. These are mixed in the factory. The mixing process also includes, pressing.

Large quantity of dust is generated in crushing machine during its operation. However, the workers are provided with dust masks. No occupational hazards were observed during the site visit. Also, little wastewater is discharged from this operation. However, large quantity of wastewater is generated by the polishing machine. It is disposed of by the use of a tanker while the residues remain. These are removed. Also, the wastewater is pumped and reused.

Inspectors from the Ministry of Labor have visited the factory and made general recommendations for the improvement of safety and health. Subsequently, the factory workers were provided with personal protective equipment as well as collective agreement between the enterprise and the Trade Union. Workers have not been told of the forthcoming privatization. The management fears that they will have a negative attitude towards their jobs.

No oil spills and asbestos material was observed during the visit. The company like most other PEs under environmental pre-audit does not have ESH records.

b. Cement Tiles and Cement Pipe Factory, Saris, Addis Ababa

This factory was established in 1938. The main products are cement tiles and cement pipes. The process is the same as at the above factory. In the factory also, limited amount of wastewater is recycled and economically used for the production; excess wastewater is dumped into the nearby city drainage without any treatment.

c. Awassa Cemental Factory

The factory was established in 1961. It is located about 270 km south of Addis Ababa.

The raw materials used include red ash, river sand, pumice, cement, volcanic ash, and basaltic stones. About 3,700 pieces/day of solid and hollow blocks, 15 pieces/day cement pipe, 2,500 pieces/day of fired bricks, 56 sq. mts/day and 64 m^3/day of gravel are produced.

There is no hazardous discharge from the facility. However, given the lack of information and overall nature of the operation, a partial audit is recommended.

1.46 Construction Design Share Company — Construction

The company is an architectural and Engineering Consulting firm which has been rendering a wide range of services in building sector (design, contract administration and material testing) since 1986 and has expanded its service range to road and water sector from 1995 onwards. The major asset of the company is its manpower, which includes about 400 technical professionals.

Based on the visit, the company does not need environmental audit.

1.47 National Engineers and Contractors Enterprise — Construction

Established in 1968. The main business of the firm is construction and engineering consulting services. This includes construction of roads, bridges, buildings, airports etc.. Also relevant engineering design services are also provided as part of main activities. The equipment used includes various type of heavy machinery including earth moving are used word work and maintenance workshops (garage) as well provide service to facilitate the activity of the enterprises. Two fuel tanks placed undergrounds are currently not is use as a result of very minimized activity in the enterprise. The quarry is also non-operational.

In regard to environmental condition, damaged and dumped machinery and equipment scattered everywhere as is in most construction enterprises. Oil sludge is accumulated in ditches and main holes.

Untrained wastewater in bays is not removed furthermore wastewater drained through small size out let is made to mix with another line of dirt generated from near by houses. Complaints are continually coming up from people living along the open ditch.

Based on the above observations the PE may require partial-pre audit visit.

1.50 Residential Houses Construction Enterprise — Construction

The enterprise was established in 1987 and its engaged in the construction of residential houses.

Based on discussion with the enterprise personnel and site visit there appears to be minimum environmental impacts. Consequently no further environmental audit is required for this facility.

1.51 Transport Construction Design Enterprise — Construction

The company is a full-fledged state owned consulting firm that deals mainly with the design and construction supervision of roads, bridges and airports. It was established in 1987 and is located in the center of Addis Ababa. The main purposes of its establishment are to engage in the activities of surveying and designing of transport construction works, to engage in construction materials testing and to render consultancy services in construction supervision and contract administration.

Based on the assessment made during the visit, the facility does not require environmental audit.

1.52 The Water Work Construction Enterprise — Construction

During the visit to the enterprises, it was understood that it is no more under PPESA, thus no environmental audit was carried out.

1.53 Ada Flour and Pasta Factory — Food

It is located in Debre Zeit town, about 45 km from Addis Ababa. The enterprise was established in 1967 to produce wheat flour, for use as a raw material for pasta and macaroni production. The factory has the capacity to grind 700 quintals of wheat and produce 170 quintals of pasta, 260 quintals of macaroni in two units of the factory.

During the process, wheat grain to separated from unwanted particles, washed and grinded at different grades through use of modern machinery. Workers are provided with respirators where high dust is given off but respirators are not used properly.

Unwanted remains of the product are used as animal food. Wastewater from the operations reused, and/or disposed through adequate system to the main septic tank. There are no significant issues associated with ESH.

As observed during the visit no further audit is required.

E.54 Adama Edible Oil Factory — Tier 3

The factory was established in 1975 as a private enterprise. However, in 1980, it was nationalized. It has 95 permanent and 63 temporary employees. The factory produces edible oil using cottonseed, niger seed, linseed. The factory uses chemicals like Caustic Soda for cleaning and bleaching and to prevent acidity.

Oil seeds as feedstock for edible oil are received in bags; the bags are subsequently emptied on the floor and fed to the cleaning and grading machines. In this process considerable amounts of dust are given off to which the workers are regularly exposed. Most of the dust emanates from machine operation and also from the poor maintenance of elevators, vibrators and ducts conveying the seed from one point to another. The site of the machine's location requires a thorough cleaning. Moreover, the workers should be supplied with proper type of respirators and masks.

The factory building has no side opening for natural ventilation. The furnace oil in the boiler room is scattered around the boiler. At the time of the visit, strong smell was emanating. This smell can be potentially harmful to the health of workers most of whom do not wear any masks.

There are four boilers in this room, of which three are out of order. This room is also cramped. The heavy air provides unhealthy work environment. As far as the waste material is concerned, the husk is collected and filled in sacks for sale as household fuel. The liquid waste is stored in a wheeled tanker for disposal on the field some five kilometers away from the factory without any form of treatment. No analytical data was available.

Workers are well aware of the forthcoming privatization. They, however, relate to it negatively due to fear of job loss during or after privatization. In general, the factory's safety and health conditions are poor.

Based on the criteria used for other PEs, this installation is recommended for a partial audit.

E.55 Addis Moujo Edible Oil Factory — Tier 3

Addis Moujo Edible Oil Share Company is the largest and most modern edible oil plant in Ethiopia was established in 1996 by merging two factories, one located in Addis Ababa, the other (a solvent extraction plant) in Modjo 73 km East of Addis Ababa. The company produces edible oil, vegetable ghee and margarine from cottonseed, rapeseed, linseed and niger seed. The company employs 268 people.

The solvent exaction plant at Modjo employs hexane (up to 50,000 liter annually). Hexane is a very volatile petrolcum product. The storage of this product in barrels in both open and closed areas is potentially hazardous. The waste generated in the process of cleaning the seed and the sludge that remains after recycling is openly burnt. Soap stock is another wastewater material discharged untreated to the main sewerage system. There is an on-site waste treatment unit. However, it has never been operational. Steps are being taken to put the unit into operation in the near future. The soap stock splitting unit uses sulfuric acid to recover fatty acid. Workers in the unit are required to wear protective devices. Another byproduct bleaching earth is disposed off through the city administration.

The fact that the waste treatment plant has not been operational for a long time has led to the discharge of wastewater untreated. The company during the visit was advised to make all efforts to operationalize the wastewater treatment plant operational at the earliest. Efforts to set up on appropriate storage for hexanes at Modjo need to be enhanced.

A partial audit is recommended.

1.56 Awassa Flour Factory — Food

The factory was established in 1987 for the production of wheat flour. It is located 270 km south of Addis Ababa. The flourmill uses 1000qls/day of wheat and produces 75% flour and 25% bran for animal feed

There are no any environmental issues, which require further audit.

1.57 Bahir Dar Edible Oil share Company — Food

Bahar Dar Edible Oil Share Company was established in 1984 in the town of Bahar Dar, located about 570 kms northwest of Addis Ababa. The company currently has 130 permanent employees. It is engaged in the production of edible oil and oil cake.

The main types of raw materials used for the production of edible oil are oil seeds such as linseed, sesame seeds, sunflower seeds, Nigger seeds (Neug) and rapeseeds (Cabbage seed). The factory uses chemicals like sodium hydroxide, sodium chloride and bleaching powder and also used to refine the crude oil. The quantity of raw material used ranges from 1900 to 2000 tones/year of oil seeds.
A number of chemicals are also used, during the refining stage of the production process. Key chemicals and their quantities used are sodium hydroxide (NaOH)-30 kg/batch of 12,000 liters, sodium Chloride (NaCl)-50 kg/batch of 12,000 liters of oil, and bleaching powder – 100 kg/batch of 12,000 liters of edible oil produced.

The edible oil output depends on the type of oil seed used as feedstock. It is estimated to be 40% edible oil from linseeds and sesame seeds and about 30% from sunflower and rapeseeds. Oil cake is produced as a by-product. It is sold as feed for livestock except that of rape/cabbage seeds which is sold as fertilizer. The factory effluents contain free fatty acids, soaps and other materials.

The process flow of the oil production is as follows: Oil seed is cleaned to remove dust and other materials. This is followed by pressing, which includes use of roller mill, stock cooker, screw press, food separator and filter. Following this, crude oil is produced. In the refinery section a deguming by sodium chloride and neutralizing by sodium hydroxide is performed where by soap stock is removed. Then follows the process of washing, bleaching, filtration and deoderization to produce refined oil, which is ready for sales.

The company stores light furnace oil in a steel tank for boilers. Although no leakage was noticed, the arrangement needs continuous care and monitoring, given the potential of oil spill and the associated environmental risks. Initially the company had a settlement (septic) tank, which was used to collect the wastewater from the refinery section of the plant. It was envisaged that the soap stock would be collected from the surface of the tank for use by soap factories, and the water under it would be pumped back for reuse.

Currently, however, the pipes leading the effluents to the septic tank are blocked by the soap stock and instead the untreated effluent is discharged through an open ditch to the surrounding green fields without any treatment. This situation has the potential to create environmental pollution.

However, in terms of potential EHS risk to various receptors and use of the evaluation criteria and ranking as discussed under section 6.0, it can be concluded from the pre-audit that the facility qualifies for a partial audit.

L-58 Dire Dawa Food Complex Share Company — Food

The company started operation in 1996. It is located in Dire Dawa, 530 km east of Addis Ababa. The factory has 219 employees. The company produces flour, pasta and biscuits. The main raw material for production of flour is wheat, and for pasta and biscuits, wheat flours. Some of the ingredients used in biscuit production are: vegetable ghee, sugar, yeast, salt, milk powder, ammonium carbonate and flavors. The flour plant has a capacity to produce 90 tons of wheat flour per day.

The company uses phostoxin (15,360 tablets/annum) for fumigation purposes. A little amount of dust escapes the cyclones in the pre-cleaning section. The company intends to prevent this by installing a back filter. During the visit, few small oil spills around the furnace oil tank were observed. The company also plans to install a collector in place for the purpose. The company is HACCP certified for its pasta production, and is working hard to get certification for its other products.

The management of the company is highly determined and committed to meet the requirements of international standard (including ISO 9001). Its HACCP certification for pasta and the ones in the pipeline for the other products is a landmark. Therefore, no further audit (except to see the fulfillment of HACCP requirements) would be required.

L-59 Ethiopian Spice Extraction Factory — Food

The company was established in 1972. It has 89 employees 10% of them are women. Its main activity is extraction of spices for export purpose.

The main products for export are Qiloresins of paprika, Capsicum, Tusmeslct Ginger and different indigenous spices, which are produced at buyers' request. The product is exported to Germany, Spain and USA.

The major raw material used is red pepper. The manufacturing process includes seed separation, chopping, use of hammer mill for crushing, and followed by distillation with chemicals. The same process is used for turmeric and ginger.
Chemicals used at the factory, primarily for cleaning, include hexane 3%, acetone 0.2%, and methanol 1%.

Regarding environmental issue, no hazardous substances, as indicated by site visit, review of scanty documents and discussions with the staff, harmful to the health or environment seems to exist. However, there is a general irritation from red pepper during the process. Also, the working environment has considerable dust. The workers are, however, provided the necessary working clothes and cloth mouth and nose respirators. The factory roof is covered with asbestos sheets but no hazard has been recognized and reported. Factory inspectors of the Ministry of Labor and Social Affairs sometimes visit the factory for general safety and health purposes. The Federal Environmental Protection Agency staff has also visited them only once on request. No liability has been reported until now from individuals or concerned authority. The factory was not in operating on the day of the visit due to cleaning and maintenance purpose.

In addition, the facility has three boilers and a fuel tanker with a capacity of 25,000 liter of petroleum. During visit, oil spills were noticed under the boiler, due to lack of cleaning and proper supervision. For the facility's wastewater there is no treatment. It is discharged to the city drainage, where it may create environmental hazards. No firm conclusion could be established in the view of absence of data. Based on the criteria used for other PEs.

This facility is recommended for a partial environmental audit.

I-60. Faffa Foods Share Company — Food

The company was established in 1962 as Ethio-Swedish Joint Venture with the objective to reduce the problem of malnutrition among Ethiopian children. The objective was to provide low-cost, high protein food. The company's current activity includes production and sale of a variety foodstuff.

The maximum production capacity of the factory is 21,600 MT/annum. However, it produces only 13,695 MT due to old equipment. Foodstuffs enriched with vitamins and minerals are also produced. FAFFA, cerifam, Dube flour are among other main products. Locally available wheat, maize, check pea, etc. are among different grains required for raw material. Auxiliary at the plant includes a boiler, an air compressor, water, maintenance workshop, and a clinic. The process is in most phases is enclosed hence the chance to sustain accident or health-impairing working condition e.g. excessive noise, dust, etc., is low. Clinical data regarding adversity of organic dust is not available. From hygienic point of view, every effort is exerted to maintain healthy disposal of waste matters. Safety-health Committee is organized to control unhealthy acts and yet one can observe neglected effluents. In a pit where solid waste and scrap is dumped and burned, groundwater penetrated through and is mixed with dirt there. It has started to let bad odor.

The company requires partial pre-audit visit.

1.61 Hamaressa Edible Oil Share Company — Food

The factory is located about 544 km from Addis Ababa. It was established in 1998. Its major product is peanut oil and also five other types of oil of oils. On average, annual production capacity of the factory is 4,500 tons. The factory uses about 1000 kg of caustic soda annually and much less quantity of bleaching earth and calcium hydroxide.

Prior to discharge, all factory waste undergoes a biological treatment in the waste treatment plant. However, the chemical section of the waste treatment plant has never been operational. There is also waste soap stock, considered an organic waste. Bleaching earth is burried in the compound of the factory. The fine dust and materials that escape the cyclone installed in the pre-cleaning section are retained by trees planted for the purpose around the area. The trees are occassionally washed. Steam pipelines are insulated with asbestos covered by aluminum boil. The factory has an underground storage tank for furnace oil. It has a capacity of 50,000 liters.

There is concern on the part of management to make the factory environment friendly. This is particularly reflected by their initiative to seek professional advice on environment and hazard issues from the Labor Office The latter's response was however limited to the use of protective devices and hence unsatisfactory and of limited use especially in terms of the needs of the factory.

In light of this, and other issues indicated above-e.g., waste treatment plant-further assessment and audit need to be carried out.

1.62 Kality Food Share Company — Food

The factory was established in 1930. Currently it has approximately 600 employees. It produces and uses wheat as feedstock. The facility does not use any hazardous or toxic chemicals. Manufacturing ammonia and sodium bicarbonate to increase the shelf life of biscuits is used. The process includes mixing, shaping, cutting, pre-drying, cooling and storing.

During the visit, oil spills were discovered around the used oil tanker as well as the surrounding areas, and also in the maintenance room. The management has taken some rectifying measures to avoid the EHS risks. The wastewater effluents from the working processes are discharged into nearby land without any form of treatment. No asbestos materials seem to exist. No other occupational hazards were discovered. Workers are provided with the appropriate protective devices. However, these are rarely used.

The company is large and complex. It manufactures five different products. The wastewater and solid wastes generated need hygienic and safe means of disposal. No environmental, health and safety information exists. Given the large size of the operation, some further investigation is warranted.

A partial environmental audit is suggested. The basis for this recommendation is the same as for other PEs under review.

F-03 Kokob Flour and Pasta Factory — Food

This factory was established in 1936. At present, it has 262 employees. The factory has two components, the flourmill and the pasta factory. The main products are flour for bread and pasta. The raw material used is wheat and the process includes pre cleaning, cleaning milling and packing.

A major problem at the factory is dust due to the use of old technology. However, workers are provided with dust masks. No effluent discharge of environmental significance was observed at the factory.

No further environmental audit is suggested.

F-04 Misrak Flour and Bread Factory — Food

Established in 1956, the factory is located in Kirkos sub-city, kebele 04. The factory is engaged in production of wheat flour, bread and biscuits. It has a milling capacity of 272 quintals/24 hours. The factory employs 340 people.

The factory, currently, out sources the fumigation service. The fumigant used is phostoxin. The cyclones and air locks in place at the cleaning and tempering sections are not quite efficient. Consequently, finer particles escape into the open air.

It has been communicated, on site, to the factory that they make a complete rehabilitation (or replacement as appropriate) of the cyclones and air locks.

There is no need for any further audit.

F-05 Nazareth Edible Oil Factory — Food

The factory was established in 1966 as a private enterprise. However, in 1975 it was nationalized. At present it has 122 employees. Its oil production capacity is 200 quintals/day. The raw materials used are cottonseed, niger seed, rape seed and lin-seed, and sometimes sun flower seeds.

The production process uses a number of chemicals to produce edible oil. These include Caustic Soda, Sodium Hydroxide, and Bleaching Earth for cleaning and neutralizing acids. The factory has a small laboratory to check the amount of fatty acids and also rancidity.

The oil seed feed stock is received in bags, which are emptied on the floor and fed to the machine for cleaning and grading. In this process, considerable amount of dust is produced. Most of the dust, however, emanates from the machine operation because of poor maintenance of elevators, vibrators and ducts conveying the seed from one point to the other. The site of the machine requires a thorough clean up. The workers are not supplied with proper type of respirators.

The Federal Ethiopian Environment Authority (FEPA) personnel have visited the factory only once in the last few years. However, no feedback was received regarding environment issue. We were also told that inspectors from Ministry of Labor have never visited the factory concerning safety and health issues.

The boiler room has a number of oil leakages in different areas. A key reason is improper maintenance. There is also an asbestos substance used for insulation of steam pipes to which the workers are not aware of the hazards and not provided with proper masks. This situation needs careful review and testing to assure that the existing asbestos is not in friable form (see section 4.1).

Workers are aware of the forthcoming privatization. The waste is accumulated in a storage tank from where the solid waste is taken by truck and dumped in open fields some 5 km away from the factory, and the untreated wastewater is discharged to the nearby land.

Overall, the factory's environmental safety and health conditions are poor.

Based on the criteria used for other PEs, the facility is classified as a Partial Audit candidate.

4.66 Dgray Flour and Edible Oil Share Company — Food

The Share Company is not covered due to unavailability of flights. However, the sector is covered under other PEs.

4.67 Yerer Flour Share Company — Food

Yerer Flour Share Company, located in Nazareth town about 95 km from Addis Ababa, was established in 1972. The company employs 118 people. The company produces wheat flour and its capacity is rated at 57 tons/24 hours.

The company uses phostoxin (1,600-2,000 tablets annually) for fumigation purpose. Also, a wheat cleaning and tempering sections generate dust and light particles. The finer particles pass the cyclones and the air locks and escape into the open air. The walls of the warehouse are partly built from asbestos.

Cyclones and air locks are meant to trap dust particles. However, at the factory, these facilities are far from being efficient, and environmental pollution occurs. The company needs to act on this issue. Furthermore, the company must replace asbestos by environmentally friendly material.

A partial audit may be required to assess these and other similar issues.

4.68 Ethiopian Hotels Enterprise — Food

Under the above enterprise, there are four entities. These are: 1) Ethiopia Hotel, established in 1962, (2) Harambee Hotel, established in 1969, (3) Ganbella Hotel, and (4) Sky Restaurant.

Since their establishment the first three hotels are engaged in providing hotel services to customers such as bedrooms, food and recreational services. As regards waste material disposal, the solid waste is collected in containers and disposed properly by the city sewerage Authority. Liquid waste is drained underground through concert tubs and connected with main waste water line of the city. Solid waste primarily contains waste food, waste plastic and other wastes such as broken refrigerators, furniture and others. Some of this equipment such as used capacitors may contain toxic chemicals (such as PCBs).

Overall, however, we believe that no further environmental audit is required.

1.69 Ethiopian Tourist Trading Enterprise — Food

Founded in 1964, the enterprise started operation with small capacity, selling posters and post cards for tourists. Through development, it established different shops and warehouses where tourists, visiting diplomats, and business travelers buy duty free items.

The enterprise owns 8 shops, where it produces and sells handicrafts and souvenirs. Its objectives are:

1. To establish, organize, manage and expand duty free shops, souvenir shops and
2. Produce and sell processed and semi processed food items.

Raw materials used to produce the above products depend on the quality of the intended items to be produced. Nevertheless, raw food crops for food processing, leather, bamboo are key raw materials. In the wood workshop and food processing, dust and scrap is produced and burnt in pits while wastewater is drained into the main septic tank. There are no significant environmental problems. Also, protective measures are used where excess noise and dust is generated.

Based on the review of the situation, discussions with enterprise personnel and use of the scoring system (section 6.0), no further audit is recommended for the facility.

1.70 Ghion Hotels Enterprise — Food

Ghion which currently operates a chain of ten hotels in Addis Ababa and in the northern part of the country was established over 50 years ago. The main hotel, where the head office is located in the city center is a four star hotel. Ghion Hotels Enterprise employs 668 workers. Solid and liquid waste is handled in an environment friendly manner.

There is no need for further audit.

1.71 Ras Hotels Enterprise — Food

The enterprise comprises Addis Ababa Ras Hotel (established in 1947), Hotel De'Afrique (established in 1966), Adama Ras Hotel (established in 1962), Kereyu Lounge (established in 1967), Assela Ras Hotel (established in 1967), Dire Dawa Ras Hotels No. 1 and No. 2 (established in 1963 and 1970, respectively) and Harar Ras Hotel (established in 1939). According to Ato Melaku Kebede, Operations Manager, all the hotels are engaged in providing hotel services to their customers. Most of the raw materials required to run a hotel is locally available. Basic service and facility relevant to a hotel is provided more or less in

all hotels regardless to the size. Input facilities are boilers, (electrical or fuel) power generators, and well water pumps. In addition, there are refrigeration systems in use at all hotels.

In Dire Dawa and Harar Ras hotels, in the past, there had been problems of wastewater disposal, affecting the surrounding areas. However, the problem seems to have been resolved by changing old pipes and tubes and also change in flow of direction made through negotiation with city administrators.

Hence, the enterprise did not have any significant environmental issues, and a pre-audit is considered enough for the hotel.

1.72 SPA Service Enterprise — Food

The Addis Ababa SPA Service was established during the reign of Emperor Menilik II. It has 380 employees. The main activities are natural hot water, hot spring bath, physiotherapy service and sauna bath. In addition, the enterprise has an exquisite restaurant, cozy bars, bedrooms with warm and cold water.

No environmental issues have been observed in the enterprise. The center is called a treatment without medicine.
Since the enterprise has no any identified problem regarding environment, the audit required is the level of pre-audit.

1.73 Wabishebelle Hotels Enterprise — Food

Established in 1975, the enterprise runs a chain of seven hotels located in the southern part of the country. The Addis Ababa Wabeshebelle-where the head office is located is a three stars hotel. The enterprise employs 534 people.

Solid and liquid waste is handled in an environment friendly manner. There is no need for further audit. An environmental pre-audit is considered adequate.

1.74 Addis Ababa Tanners Share Company — Leather

The company was established in 1925 as the oldest of its kind in Ethiopia. It is located at a distance of 13 km from the center of Addis Ababa. The PE's main products are shoe uppers and linings from hides and skins, garments and from sheepskins and hides, leather soles from hides, bag leather, upholstery leather and wet blue, crust and finished leather for expert. The total output of the factory averages 5,000 kg of hides per annum. Besides raw hides and skins, the factory uses for various process 72 tons per month of various chemicals including soda ash, sodium, sulfide, sodium sulfa hydrate, lime powder, ammonium sulfate, tan chrome, sulfuric acid, 11 tons of dyestuffs per month and 2 tons per month of auxiliary chemicals.

The factory discharges wastewater, which is estimated at 200 m^3/day directly into the nearby stream, without any treatment. The PE received a warning from the environmental protection authority (FEPA) a year ago to establish a wastewater treatment plant within 5 years time or face a total closure of the enterprise.

Based on the assessment made during the visit the factory discharges wastewater, which could be hazardous to various receptors. Based on the evaluation criteria used elsewhere, the PEs a candidate for partial audit.

1.75 Asheo Shoe Share Company — Leather

The company was established in 1975. It is located in the center of Addis Ababa. It is engaged in the production and distribution of various types of leather upper shoes for gents, ladies and children. The machinery layout is designed in such a way that production of shoes can be carried with content lasting or stitched down operation methods. The main raw materials are shoe upper, sock lining, PVC granule for sole making, last raw materials and packing materials. The attainable output level is 1,500 pairs of shoes per 8 hours shift.

There is no wastewater discharge of any type, which requires further audit. Overall, the facility functions in an environmentally safe manner. The pre-audit conducted is considered sufficient to gauge the potential of environmental liabilities under the project.

1.76 Blue Nile Shoe Share Company — Leather

The company was established in 1958, and it has a total of 682 employees. The main lines of business are production of military shoes and production of glue such as sole glue, vulcanizing glue, P.U. glue and casting glue for factory and to the local market. The main process lines are cutting, stitching, lasting, bottoming and finishing. It produces 536,000 pairs of shoes and 200,000 Kg of glue per year.

Different types of chemicals are used to produce various types of glues. The production system uses hoods and exhaust ventilation mounted on various machines. However, workers were complaining of fumes and vapors, which were given off around the working area. Workers were not provided with masks specially those working in the ink spray, and coloring machine. Regarding wastewater, no hazardous discharge was observed, but as far as solid waste is concerned, huge amounts of Trimmed leather and rubber Solid waste were dumped in the factory area. This offers the potential of chemical leakage to the groundwater. Overall, the ESH issues are also poorly managed. Based on the visit and knowledge of industry, a partial environmental audit is recommended.

Considering the non-hazardous and environmentally insignificant issues at the PE, no further audit is recommended.

1.77 Combolcha Tannery Share Company — Leather

The tannery was established in 1964. Currently, it has 102 employees. The PE produces wet blue goatskins to a capacity of 5000/day. The raw material used is salted or dry goat skin. The process includes trimming, soaking, lining, and tanning.

The company uses different chemicals and dyestuffs for cleaning, bleaching, strengthening and shearing process. The chemicals used include phosphate, sodium sulfa hydrate, lime

powder, sodium silica fluoride, ammonium sulfate, formic acid, sulfuric acid, and chrome powder.

At the tannery, a large number of chemicals are used in most processes, and the tannery personnel are provided protective equipment. Thus, hazardous workplace environment is minimized but not eliminated. However, given the nature of the work, unpleasant smell is common in the tannery and surrounding area.

Regarding environmental issues, the tannery in general has poor environmental conditions. For instance, the wastewater comes out of the working area in an open drainage and it goes into settling tank, where filtration and precipitation takes place. The residue from tank is taken out and collected and dumped in an earthen pit specially designed for the purpose. The wastewater is disposed into a nearby river without treatment. The company had bought a treatment plant some 18 years back and they did not assemble it due to financial constraints. I have been informed that with small certain modification if there is available fund the machinery could be operative.

Due to the condition and type of wastes generated, the potential of EHS impact to surrounding residential areas could be significant. In addition, overall poor operational and housekeeping procedures were observed.

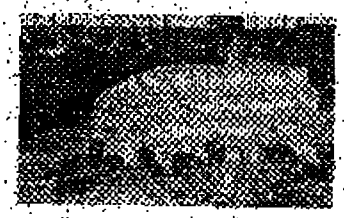
Coupled with tannery industry characteristics (section 4.3), tax regulatory enforcement, poor record keeping and the criteria used for all other PEs, a full audit is recommended.

4.7.4 Ethiopian Tannery Share Company — Leather

Ethiopian Tannery is public enterprises established in 1959 with technical assistance of Czechoslovakian government. The Tannery is located in Koka near Modjo about 90 kms, south of Addis Ababa.

Ethiopia Tannery: Export Leather

Ethiopian Tannery: Drying Hides

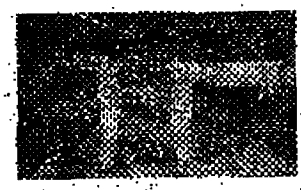


Ethiopian Tannery: Raw Hides

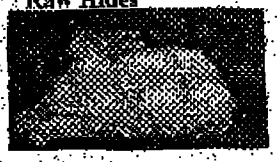
The tannery started production in 1976 with 293 Ethiopian employees and 12 Czechoslovakian experts. At the start of trial production, raw materials included were about 3000 pieces of skins and 400 cowhides. Today the number of employees has reached to 850 permanent and 190 temporary. In addition substantial equipment and personnel investments have also been made.

The tannery is the first of its kind to produce semi-finished and finished leather both for domestic and export markets. It is also one of the largest and the most modern tannery in Ethiopia. It's fully equipped with modern production lines for cattle, hair sheep and goatskins up to the finished stage. The raw material for the tannery comes from large domestic livestock population of the country, estimated at 27 million of cattle, 24 million of sheep and 18 million of goats.

The tannery's various machinery and equipment is hydraulically, pneumatically, and electrically controlled. Renovations include replacement of a significant number of



Ethiopian Tannery: Raw Hides



Ethiopia Tannery: Semi Finished Leather Picket and Wet Blue

machines in the wet-end production section during the last 10 years. At present, the tannery is processing 12,000 pieces of sheep and goatskins and 1,300 pcs of hides per day. The main items currently produced at the Tannery include Pickle sheep skin, Wet blue hide and skin, Crust hide and skin, Finished garment leather, nubuck, etc.

About 80% of the total production is exported to the international market in the form of semi processed and finished leather. The remaining 20% is sold locally being finished for shoe factories and garment industries. Almost all processing Chemicals, syntans, fat liquors dyestuffs and finishing chemicals are imported from abroad.

1.29 Modjo Tannery Share Company — Leather

The tannery was established in 1964 by a French investor in Modjo town, about 75 Km east of Addis Ababa to process crocodile skin. At that time, it was called Dufan Tanneries. However, in 1974 it was nationalized. Raw material used is goat, sheep and lamb hides. At present, only 4,100 processed skins are produced against an installed capacity of 8,500 skins/day. Like Ethiopian tannery, this tannery also uses large number of chemicals, most of which are environmental contaminant.

Modjo Tannery: Mojo Ethiopia

During the visit, it was observed that a number of operations are carried out in an unhygienic manner. For instance, floor areas were wet, and workers were dipping their uncovered hands into large pails containing chemical solutions. In addition, piled skins on the floor are painted with chemicals. The spilled chemicals are washed and allowed to run to the drainage channels without any treatment. This environmentally unsound can use CP techniques by using an intermediate collection tank for potential reuse, recycle or if not feasible, environmentally disposed. Estimates elsewhere indicate that such wastewater contains 16-17% of chemicals used. A number of pipes were covered with loose asbestos material. The factory's residual sludge is stored on the premises. No record keeping was available.

The situation at the Modjo tanneries needs a full environmental audit.

1.30 Ethiopian Crown Cork and Can Factory — Metal

The factory was established in 1962. At present, it has 160 employees. Its major business activity is the production of crown corks and cans. Raw material – Tin free steel for cork and Electroliting Tin plate for Cans. The company has two production lines:- Crown cork line –10

million, Gross/annum and Can line- 5 million pieces/annum. In the Cork line, the process includes trimming, sizing, printing, varnishing, drying, and pressing. In the Can line the manufacturing process includes cutting, trimming, sizing, spot welding, curling and limning.

Chemicals used at the plant include chemical coatings of unknown composition (sold under trade names), solvents, thinners, PVC compound solvent resins and others.

No liability has been made from individuals or concerned authorities regarding any environmental or health and safety (EHS) violations. In the drying machine and around the plastic injection machine, LP Gas and the PVC sealing machine emanate gas fumes inside the working place and outside the environment. The company recently installed exhaust hoods to combat the harmful effect of gas and fumes; but the smell is still eminent. Excessive noise was also observed in the plastic injection machine and in the areas of press machine. Even though workers are provided with earmuffs, they do not wear it. Oil spill was also observed around the machine shop area. The workers use rugged cloth to clean the oil and dirt and dump it in a barrel prepared and put for this purpose and then it would be taken to enclose fireplace for burning rubbish.

The effluent is discharged to the nearby land without treatment. Ministry of Labor Inspectors have visited the factory concerning safety and health and had given recommendations to safeguard the safety and health of workers. Regarding privatization, most workers are well aware of privatization because for many years the company is jointly owned by the government of Ethiopia with 75% share and Crown Cork and Seal Inc. of USA the remaining 25% share.
Based on the pre-audit, the facility is recommended for a partial audit.

1.31 United Abilities Factory — Metal

UAP was established in 1964 with the prime objective of giving economic employment to disabled persons. Using its long experience, currently, the factory operates to achieve its dual goal of employing disabled people and producing a wide variety of products. These include "Everlight" R-20 Dry –Cell battery, 24" Men's Nylon Umbrella, 19" Women's Nylon Umbrella, Auto Folding Men's & Women's Umbrella., 28" Golf /Partners/ Umbrella, Garden Parasol Umbrella, Children Umbrellas, and Religious Umbrellas. Several process at the factory have the potential to create environmental, health and safety (EHS) issues. These include nickel plating, oil spills ground the working area and possibly friable asbestos. This situation warrants further review.

A partial audit to further gauge the situations is recommended.

1.32 Bele Bultuk Construction Stone Production — Mining and Mineral

The company was established in 1987. Currently it has a total of 143 employees. The PE's main products are gravel stone and selected materials.

Regarding environmental issues, large quantity of dust is generated by the operation of the crusher. Workers at the crusher have been supervising the operation from an observing room specially designed for these purposes. In addition, workers are provided with the necessary protective equipment. The steps to be taken include improving ventilation and using

breathing masks until the necessary improvements are made. Explosives are also used but it has been observed that it was highly secured and only people trained for this purpose. In addition, trained security men operate the equipment whenever the need arises. Oil spills were also observed around the garage and few other areas.

The environmental audit recommended is partial audit. This is based on the criteria used for all other PE's.

L.83 Ethiopian Petroleum Enterprise — Mining and Mineral

The PE was initially established in 1961, called as Ethiopian Petroleum Share Company. Later, the PE was restructured and named EPE with a mandate to import and distribute purified petroleum products. In addition, the enterprise is engaged in other related activities to meet its objectives. The PE imports Liquefied Petroleum Gas (LPG), motor gasoline, jet fuel, kerosene and fuel oil. These products are supplied by Shell, Mobil and Total, each a major oil company.

Regarding environmental pollution, relevant data was not available. However, earlier, EPA was importing leaded gasoline. However, given adverse environmental impact of leaded gasoline, this use was discontinued. Regarding EHS impacts, it can be stated that the distribution and use of all petroleum products involve varying degrees of risks.

While keeping this in mind, it can be stated that, based on the team's visit to the EPE administrative office in Addis Ababa, no further audit is required.

L.84 Adola Gold Development — Mining and Mineral

Adola Gold Mining is located in Shakiso, Oromia Region. It was established in 1942. According to briefings given here by Ato Taddese Hailemariam, representative at the back office, objectives of its establishment is to produce gold in placer mining by means of extraction. Pressurized water is used to wash off the soil to separate gold particles. Mercury is added to stick on and prevent the particles from running away. Soil mud left in the pit is filled up with more soil in order to avoid contamination.

Main head office is located at Shakiso where essential facilities are available. Electric power (diesel) station, water pumps are the main inputs. All are moved when site distance increases. Pits and ditches are not left open but filled up to avoid falling accident. Water is hardly found and requires 20-25 Km length of pipe to pump from ponds to the sites. Potable water is also supplied from well untreated. The enterprise provides medical service in its hospital at Shakiso to the community (non-employees) with reasonable payment. A point raised by AtoTaddese is a crucial problem faced by the enterprise, to habitants and people coming from any corner of the country infiltrates into the territory owned by the enterprise to exploit gold illegally. Solution even at government level is not yet given to stop them.

In general, the enterprise qualifies for partial audit.

1.35 Industrial Project Service — Others

This facility is a consulting service office. They have no manufacturing or any other facility causing environmental impacts.

No additional environmental audit is needed.

1.36 Ethiopian Pharmaceutical Manufacturing Share Company — Pharmaceutical and Health

The company was established in 1964 as Ethiopian Drug Manufacturing and reestablished as a public enterprise in 1994. Encompassing the major conventional dosage forms, the production department produces over 45 drug products through its five main units, namely table unit, capsule and oral powders, small volume parenterals/injectables, large volume parenterals/infusions, and oral solutions and ointments.

All the workers are provided with the necessary working cloths and the production area looks clean. As washings of floor and equipment, which may contain some toxic chemicals is discharged to the city drainage without any treatment, the facility requires a partial audit to make sure that it is not hazardous to various receptors.

1.37 Pharmaceutical and Medical Supply Share Company — Pharmaceutical and Health

The company was established in 1994. Currently, it is engaged in the import and wholesale of pharmaceuticals and medical supplies. During the visit, discussions were held with key staff. Based on these discussions, it was concluded that the company has a problem of disposing expired pharmaceuticals and diagnostic chemical and some radioactive equipment.

Currently, the expired pharmaceuticals are disposed off by open burning, without incinerator in the premises of the company under the authorization and supervision of Drug Administration and Control Authority. Expired diagnostic chemicals like x-ray chemicals and fixers are being stored. These await the discussion of the concerned authorities.

Based on the assessment made during the visit, the facility requires a partial environmental audit. While assigning this classification, all other criteria, as for other PEs was also used.

1.38 Berhanena Selam Printing Enterprise — Printing

The firm was established in 1921. Essentially, the enterprise is a printing press for producing religious books. After steady growth, it new and modern printing technology was acquired in 1963, with the objective of printing, engraving and also publishing and reproducing printed matter. Monopod film composition, offset, web offset and security printing machines are used print and produce/reproduce various products. Some of them are large quantity of textbooks, magazines, booklets, periodical prints etc. Major raw materials used are paper, ink, plate film and chemicals, others the use f letter press (outdated technology) is in use in most printing presses. Hot lead composition of letters involves exposure to lead fume and dust

obviously hazardous to health. Lead dust combined with flour dust is unscientifically disposed. The use of chemicals is for applications such as photolito, scanner (computer) and offset printers; nitric acid is used for engraving to form rubber stamps.

It is likely that waste materials disposed in liquid or solid from may contain mixture of pollutants. For workers directly exposed to hazardous condition, protective equipment (PPE) is proved. Various types of chemicals (more than 100) listed under lead stock, are stored for the last 15-20 years stored chemicals could be potential hazardous.

A full audit is required.

1.89 Educational Materials Production and Distribution — Printing

The enterprise was established in 1980. It produces gypsum, chalk, science kits and various types of house, school and office furniture. It has also a branch, which is engaged in printing of textbooks. Some of the raw materials used are calcium sulfate, and plastic materials like PVC, HDPE and boro silicate glass. Key environmental issues at the enterprise include observed emission of gas around the working area, accumulation of wastes of calcium sulfate, baro silicate and acrylic plastic in the compound.

Given this situation, the facility is recommended for an environmental partial audit.

1.90 Ethiopian Pulp and Paper Factory — Printing

Located 110 km east of Addis Ababa, The Ethiopian Pulp and Paper Share Company, started its operation in 1970. The company employs 570 people. The company uses the major raw material, pulp to produce various types of papers for writing, printing, duplicating and typing purposes. The annual production capacity of the company is 12,174 tons. Other raw materials used include scrap paper, size press starch, dyestuff, and chemicals (annual consumption: 1192 tons). The chemicals used are rosin, aluminum sulfate, China clay, polyamine and antifoam.

There is a discharge of wastewater, containing, fiber, fillers (China clay) and dyestuffs. The fiber, prior to discharge used to be biologically treated in a settlement pond. The settlement pond-which is somewhat far from the factory compound and has not been operational for the last four years. As a result fiber is being discharged untreated. Management of the company also indicated that the untreated wastewater is also being used for irrigation by farmers in the surrounding area. Draft policy on safety has been prepared by management for submission to Board of Directors. The company has underground storage tanks for diesel and petrol (capacity about 15,000 liters each), and over ground tanks for furnace oil (total capacity about 700,000 liters). However , these have not been checked for potential leakage.

The company seems, by and large, environmentally friendly. The wastewater treatment system, however, needs to be made operational.

A partial audit may thus be necessary.

1-91 Gondar Printing Enterprise — Printing

This enterprise could not be covered due to its distant (700 km) from Addis Ababa) location. However, the sector has been covered elsewhere under another PE.

1-92 Addis Phosphate Fertilizer Complex Project — Phosphate

This facility is a consulting service office. They have no manufacturing or any other facility causing environmental impacts.

No additional environmental audit is needed.

1-93 Addis Ketema Sweets Factory — Sugar

The factory, a small establishment makes various types of sweets. It is located in Addis Ketema sub-city. It was established in 1956. Sweets are produced from sugar, glucose, and essence. The factory employs 35 people.

Understandably, there are no toxic or hazardous materials used at the factory. There is little wastewater, and noise pollution level is low. Small quantities of (environmentally safe) solid wastes are generated and properly disposed. The drying room employs small charcoal oven for supplementary heating. This could generate the lethal gas-carbon monoxide.

Addis Ketema Sweet factory is a facility with very awkward layout, which may have insignificant impacts from ESH point of view. No further audit is recommended.

1-94 Ethiopian Sugar Industry Support Center Share Company — Sugar

This facility is a consulting service office. They have no manufacturing or any other facility causing environmental impacts.

No additional environmental audit is needed.

1-95 Finchaa Sugar Factory — Sugar

This factory could not be covered because it was closed for maintenance.

1-96 Metahara Sugar Factory — Sugar

This factory could not be covered because it was closed for maintenance.

1-97 Wonji Sugar Factory — Sugar

Key environmental issues at Wonji Sugar Includes.

- Accumulation of sludge formed by scrap and cuts of cane were observed along the crusher at the start of the process.

Low Stack Height
Addis To Air Pollution
Wonji Sugar

- Number of oil spills around machinery and walkways.
- The platform around the pan boilers, at the time of the visit was is covered with sticky mud formed as a result of humidified mixture of dust and spattered cane juice.
- Boiler gives off fly ash which spreads in the work areas.
- Gravel collected from beneath the steam boiler contains silicon mix and is dumped in the open field without paying any attention to the nature of the mixture.
- Untreated wastewater drained in two parallel ditches and is pumped out to grassy land intended to allow the water flow through and rich the cane farm. The swamp is not fenced to prevent entrance. The place (swampy) is possible to cause Malaria by producing mosquitoes.

The factory qualifies for full pre-audit visit.

I-98 Addis Garment Share Company — Textiles

The factory was established in 1975 as public enterprise and is located in Addis Ababa. The major inputs are fabrics, interlining, sewing, thread, button and packing materials. The factory's attainable capacity is 1,200 shirts per day.

There is a little water discharge with no significant environmental effect.

I-99 Akaki Garment Share Company — Textiles

Akaki Garment Share Company is located in the industrially zoned Akaki town 25 km from Addis Ababa. It was established in 1971. The company produces various types of garments (for example, 600,000 shirts annually) from different fabrics; cotton, polyester and viscous materials. The company has 599 workers.

The production process and the machines (which comprise of different types of sewing, cutting and ironing machines) used are environment friendly and no significant quantities of wastes are produced.

No further audit is required

I-100 Akaki Textile Share Company — Textiles

The mill was established in 1960 with used machinery brought from India. The firm has over 2,057 employees. It is located about 25 km from Addis Ababa. At present, of the total 849 looms, only 250 looms are operational. Various reasons were given for this situation. Included were poor management, and lack of availability of spare parts and lack of demand. The finishing department operates 16 hours/day and spinning and weaving 24 hours/day. Plant's total production is indicated at 1.5-2.0 million square meters. This amount is about 55% of the installed capacity. Most of the production is for domestic use.

Akaki Textile Factory:
Obsolete Equipment

The manufacturing process uses several chemicals, a number of which are toxic. Included are sodium sulfa hydrate (72%), sulfuric acid (98%), hydrochloric acid, sodium hydrosulfate (88%) and acetic acid (50%). In addition, various dyes are also used.

The large factory, including administrative offices, occupies over 7 hectares of land.

Various dyes used annually include 300-500kg of direct dyes, 1,500-2,000 kg of reactive dyes, and 1,000-1,500 kg of vat dyes. Included in this are, for cost reasons, sulfur dyes and other dyestuff with active halogen component. In addition, 2,000-2,500kg of sulfur, 500-1,000 kg of Azoic and 50-100 kg of cationic are also used annually. It uses 7 tons per month of used oil for its boilers.

Akaki Textiles Factory
Untreated Wastewater
Used for Growing Grass

The mill discharges its untreated wastewater (had light bluish color at the time of the visit) directly into an open creek. The existing treatment system is non-functional. No analysis of this water has ever been done. Likewise, the solid waste sludge is disposed off in a pit and occasionally burnt. When stored, it gets washed out with rain; the supernatant water goes directly into the river. During the visit, a number of pipes were covered with asbestos. In few places it was crumbling and friable, making it airborne and environmentally dangerous. In addition, around the factory premises, in few places, oil spills were also noticed. No analysis for the plant's air, soil or wastewater was available.

Overall, EHS data and information was not available. Staff from FEPA and the Ethiopian Labor Ministry occasionally visited the factory.
However, no documentation was available for review. Overall, the EHS record of the factory is rather grim.

Based on the visit, and the criteria used for other facilities, the factory needs a full

1.101 Arbaminch Textile Share Company — Textiles

The company was established in 1991 in Arbaminch town, 500 Km from Addis Ababa. The factory has two principal production departments, namely spinning and weaving department. The spinning department consists of 15,000 ring spindles and 1,728 rotors. The weaving department has 232 shuttles rapier looms. The product mix consists of grew woven fabrics in the form of 35% polyester and 65% cotton blending ration. The annual production capacity reaches up to 27 million m2 of shirting, dressing and suiting.

The factory uses 600 Kg/day of wheat flour, 15 kg/day of tallow and 15 kg/day of Arabic gum for sizing of warp yarn before weaving. The only discharge coming out from this factory is the washings of the sizing boxes, which contain above-mentioned products. The washings are drained into a pond and sucked by a truck as it get tall to be damped elsewhere.

The facility requires a partial audit to check the effects of these effluents on other receptors.

1.102 Awassa Textile Share Company — Textiles

The factory was established in 1989 in Awassa town 270 km south of Addis Ababa. It has an attainable capacity of 8,445 million M^2 of 100% cotton fabrics. Key raw material used include 1,100 tons/year lint cotton, 750 tons/year basic chemicals like caustic soda, H_2O_2, acetic acid, sodium hydrosulphite and soda ash, 2.5 tons/year of reactive dyestuffs, 1.6 tons/year of Vat dyes, and 5.7 tons/year off Vat disperse dyes

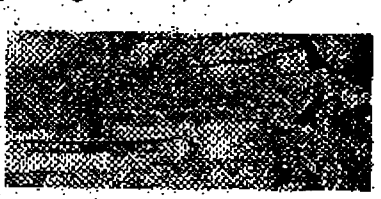
The factory discharges an effluent containing residual dyestuffs and chemicals with a flow rate of about 160,000 m^3/year. Although the factory has a (currently malfunctioning) wastewater treatment plant, it requires spare parts and maintenance. Also rehabilitation of the acid closing unit is needed.

Furthermore, it was noticed during the visit that the discharge from the lagoons to the nearby swampy area is not properly treated. Given the complexity of the operation and heavy use of dyes and other chemicals, it is very likely that the untreated wastewater is (heavily) contaminated and causing damage to the environment. The factory has no arrangement (such as an in-house laboratory) to test it.

Likewise, the air emissions have also not been tested. Given this situation, and the criteria used for other facilities, the factory is recommended for a full environmental audit.

1.103 Bahir Dar Textile Share Company — Textiles

Bahir Dar textile Share Company was established in 1961 in the town of Bahir Dar, about 570 km northwest of Addis Ababa. It is an integrated textile mill manufacturing 100% woven cotton fabric. In 1989, the factory rehabilitated its spinning and weaving section replacing most of the machines and renovating the rest. The company has currently 1800 employees. The major products being manufactured include yarn and all kinds of finished cloths from cotton, and textile goods for household use. The major production departments of the company are spinning which includes 20,000 spindles imported from Italy, weaving has 93 shuttle, and 134 rapier looms also imported from Italy. The finishing section has 10 jiggers, 1 padding machine, 1 stenter, and one flat screen printing machine, etc from Germany and Italy.



Bahar Dar Textiles: Untreated Factory Effluents Discharged to the Nile River

The factory operates in three shifts each of eight hours each and has an annual installed production capacity of 270 tons of yarn (at Ne. equivalent), 21 million square meter of gray fabric and 19.7 million square meter of finished fabric.

The major raw materials used by the company include: Lint cotton 310 tons/year and basic chemicals including caustic soda - (45.5% w/w), 27,000 liters/year, hydrogen peroxide 50%, 12,600 liters/year, acetic acid 50%, 1,200 liters/year, organic

Bahar Dar Textiles: Untreated Wastewater Ends Up is the Nile River in Close Proximity

stabilizer 50%, 3,500 liters/year, sodium hydrosulfate 88%, 8,000 liters/year and soda ash 78%, 500 kg/year. In addition, auxiliary chemicals are also used. These include binder, 9,900 kg/year, thickener, 2,400 kg/year, emulsifier, 1,400 kg/year, fixing agent, 1,200 kg/year, urea 46% N, 3,000, pigments for printing, 2,400kg/year, vat dye stuffs for dyeing, 2,500 kg/year and reactive dye stuffs for dyeing, 450 kg/year. Currently, no EMS related activities are being implemented at the factory.

At present, an estimated quantity of 180,000 liters/day of untreated wastewater is being discharged through an open ditch directly to the nearby Blue Nile River from the dyeing and finishing departments of the company. It was also noticed during the visit that there are spills of the furnace oil around the large container. This container is used to store the oil for the boilers. Most of the workers were seen working without any protective devices. The management indicated that workers are provided with PPE including overalls, gloves, boots and mouth-nose covers for use in the environmentally unsafe areas.

Given the nature and size of the operation, and based on observations and review of available information, this facility needs a full environmental audit.

1.10.4 Combolcha Textile Share Company — Textiles

Combolcha Textile Company was established in 1986. It currently has 2206 employees. The company's main products are fabrics, bed sheets, terry towels, and reeled and cone yarns. The main processes include spinning, weaving and finishing.

Asbestos material in friable form seems to exist in ceiling. No awareness or attention is given to the potential health effects. In the friable form, asbestos can be air borne and environmentally dangerous. The Ethiopian Privatization and Ministry of Labor personnel have visited the company and made recommendations for the improvement of safety and health and environment. Workers in most of the working environment were given the necessary protective equipment and they wear it.

Oil spills were observed around the furnace tank due to careless handling in filling the tank. The company has a wastewater treatment plant of bacteriological treatment type. The industrial and sanitary waste goes to a mixer tank and then passes through different filtration process by wire mesh and sand. After the process the sludge is used for fertilizer around the compound, and the treated wastewater comes out of the factory and disposed to the nearby river.

Analytical data, provided by Addis Ababa Water Sewerage Authority Central Laboratory Service to the company, was available for review. However, this data is 9- years old and may not have applicability to the existing situation

In-house, the company has very few instruments for chemical analysis but in order to work out their own data, the company needs BOD and COD instruments to analyze the day to day result of the wastewater treatment.

Given the conditions and general industry knowledge as well as use of ran king criteria for other PEs, a full audit for the facility is recommended.

1.405 Dire Dawa Textile Share Company — Textiles

Established in 1939, Dire Dawa Textile Factory is located in Dire Dawa, about 530 km from Addis Ababa. The factory employs 2,626 people. The factory is an integrated mill producing three main products: yarn for knit wears manufacturers, acrylic yarn and fabrics. Raw materials used by the factory are raw cotton (18 ton/year), acrylic fiber (1.5 ton/day), dyestuffs and chemicals (1,595 kg/day).

Caustic Soda, bleaching agents, and all other materials generated as waste are discharged into the open land without any treatment. The strategic plan indicates that a waste treatment plant would be installed in the near further. Also the suction system in the spinning section has long been out of operation, the working environment, overall is hazardous. Moreover, the factory's machines are very old and the outdated technology generates noise pollution. Ceilings of the production halls and pipe insulation are made of asbestos. There are on- sits storage tanks for petrol (13,950 liter), diesel (22,400 liter) and furnace oil (450 tons).

Being very old, with obsolete outdated technology, the overall situation at the factory, leaves much to be desired. However, given the nature of the operation, knowledge of the industry and use of ranking criteria, a full audit is recommended.

1.406 Ethio-Knit Yarn Factory — Textile

The factory is basically a spinning and dyeing plant. It produces industrial grade sewing thread. The spinning plant processes 100% cotton fiber in various colors, some of which are directly sold as gray yarn and the remaining is twisted and dyed as sewing thread.

The sewing threads undergo five main processes at the dyeing plant. Kiel boiling, a treatment with sodium hydroxide (caustic soda), is used to remove natural impurities. The process of mercerizing increases dye affinity and improves luster. Neutralization, a treatment with sulfuric acid is use to neutralize the alkali. Bleaching a treatment with hydrogen peroxide, caustic soda, detergent and sequestering agent is used to remove the natural color of the material. Dyeing process colors the material with different types of dyes.

For various production processes, the factory annually uses a total 74,784 kg of various chemicals. These include auxiliary chemicals such as softeners, detergents, emulsifying agents, hydrogen peroxide (H_2O_2), and 444 kg of dyes. The types of dyes used include vat dyes, dispersed dyes and others.

Environmental issues observed at the facility include old asbestos, some crumbling, and untreated wastewater discharges with high pH (around 9.0) due to the extensive use of sodium hydroxide. Effluent from the plant primarily consists of used dyes, auxiliary chemicals like softeners, dispersing agents, detergents and basic chemicals including used caustic soda. In addition sulfuric acid is also discharged from the dying plant. The facility has a wastewater treatment plant and when operational, works as follows:

The plant's wastewater is discharged from the process department to a concrete tank for settlement. The treatment of waste sludge produced is stabilized with the use of the aerobic and facultative bacteria present in the residual wastes. The bacteria live in colonies and reproduce in an exponential manner under certain conditions. The organic substances in suspension are dissolved in a colloidal form, and being unable to form sediments, can now from sediment in the subsequent sedimentation phase having grouped into flakes, which can form sediment.

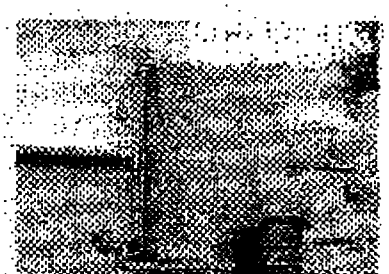
While there is an on-site wastewater treatment plant, it has been shut off for quite sometime due to reduced yarn production and poor maintenance. Thus, the untreated effluents are discharged into an open drain, which runs into a bigger creek. The situation has the potential to pose serious environmental concerns.

The sludge deposited, as sediment is regularly recycled to the oxidation tank or drained off to sludge drier. The treated wastewater, considered environmentally safe (no chemical analysis was available of the time of the visit) is discharged out of the plant to the near by river. The facility requires that for various environmental parameters, the treated wastewater should not exceed COD $\leq$ 500 mg/liter, BODs $\leq$250 mg/liter, and pH value of 9.5-10. However, again no chemical analysis was available at the time of the visit. Based on the site visit, partial environmental audit is suggested.

Given the (polluting) nature of the industry, especially given the use of variety of dyes, it is likely that a full environmental audit may be required.

1.107 Ethio-Japan Synthetic Textile Factory — Textile

The factory was established in---- and is situated in the city of Mojo, 70 Km from Addis Ababa. The factory is equipped with weaving and finishing machinery for the production of woven and dyed nylon and polyester fabric. The capacity of the finishing section is 36,000 yards per day of nylon fabric. By November 2004 the factory will have 60 more rapier looms and starts producing cotton fabric. Chemicals like caustic soda, sodium hydrosulphate and dispersing agents and various types of dyestuffs are used in the finishing section.



ETHIO Japan Textile Used Oil Polluting The Factory Premises

The factory had a wastewater treatment plant, which was erected 10 years ago and now not functional. Currently the wastewater from the finishing section is discharged, without any treatment into Mojo River.

Given the nature and size of operation, and based on observation and review of available information, this facility needs a full environmental audit.

1.108 Gullele Garment Share Company — Textile

The company, established in 1975 is located in the west of Addis Ababa the center. It is engaged in the production of various kinds of garments with an attainable capacity of 420,000

pieces of shirt equivalents per annum. The company has 414 employees of which 88% are female.

All the workers are provided with the necessary working cloth and the working environment looks clean. According to the assessment made during the visit and discussions with the company officials, the facility does not require any further audit.

1.109 Nazareth Garment Share Company — Textile

The factory was established in 1966. It is engaged mainly in producing garments. The factory has a total of 900 employees, the majority of them are women. Mostly, the raw material used is imported from China. At the factory, cutting, sewing and packing process is carried out. The factory produces worker uniforms, mostly for export to USA.

Workers are well aware of the forthcoming privatization. No hazards and effluent problems were observed. The safety and health conditions for the workers appear to be good.

Based on discussions with the staff, and on-site observations, and the ranking criteria used for other PEs, it appears that the facility does not need further environmental audit.

1.110 Nitas Silk Thread Factory — Textile

The factory was established in 1967. Currently it has 170 employees, 50% of which are women. The factory is mainly engaged in producing sewing thread, different thread and industrial threads and variety of other threads. The raw material yarn is placed on big cones. The various processes include doubling, twisting and gassing to avoid fibrous materials and to make the yarn smooth and shiny. This increases the 'affinity' for dying. Rolling, drying, squeezing and mercerizing with caustic soda is done to improve shining and to prevent impurities.

Finally, the thread goes to winding which is the final product for sale. The factory has not been fully operating for the last four years due to weak business volume.

Chemicals used include formaldehyde, 650 kg, sodium bisulfate, 51.8 kg, sodium carbonate, 100 kg, hydrogen peroxide, 135 kg, and sodium hydrosulfite 1876.8 kg. In addition to perfume 12 kg various dyes are also used.

The factory roof is covered with asbestos sheets and no harmful effect to health had been. Also, the workers are well aware of the forthcoming privatization process.

The plant's wastewater is discharge through concrete pipes for accumulation in a sedimentation concrete tank of 5x10 square meter. The water flows out to the city drain with out any treatment. It appears the facility does not need further environmental audit.

1.111 Asbessa City Bus Service Enterprise — Transport

The enterprise was not covered because it is no more under PPESA.

1.112 Bekelcha Transport Share Company — Transport

Bekelcha is one of the five state owned freight transport enterprises established in 1994 up on the dissolution of the former holding corporation-Ethiopian Freight Transport Corporation. The company is located in Nazareth town some 100 km from Addis Ababa. Bekelcha, with a fleet of 171 trucks with trailers, is engaged in dry cargo freight transport. The company employs 583 people.

Used oil about 12 barrels per month is generated by the fleet. The oil is sold off. Wastewater from the truck washing station is discharged (without any separator) to the surrounding area. There are oil spills around the area where used oil is kept prior to sale. The solutions for the above mentioned environmental issues have been communicated, on site, to the company.

No further audit would be required.

1.113 Comet Transport Share Company — Transport

The company was established in 1994. Its previous name was "Ethiopian Cargo Transport Organization". Its main business activity is to provide heavy truck transport services to Djibouti Port and to all parts of Ethiopia. In addition the firm is also engaged in cargo handling, dry-port service and tyre re-threading. The in/out movement of 38,000 trucks/year (coming for service) has turned the asphalt ground to gravel and as a result high amount of combined dust pollutes local air zone of the premises adversely.

At the facility, gasoline mixed with water and used to wash the trucks in a large bay. However, the system designed to discharge the effluents does not seem to be effective. All type of dirty matter is allowed to mix in the wastewater sewer. Subsequently, the system is filled with greasy and oily mud. Literally, one can see heaps of combined sludge and all kinds of scrap dumped everywhere. The management appears to be insensitive to the situation. No reports were available regarding the visits made by Ministry of Health nor Ministry of Labor and Social Affairs personnel.

Company's, attempts made to treat wastewater have failed as a result of poor system design and other (unknown) reasons. Hence, the untreated effluents are discharged to an open field making its way to settle in the grassy and swampy area.

A plant to retread large size tyre is located in one corner of the compound. Heavy smoke with soot is given off when piled rubber scrap is burnt up. There are no systems to collect fine dust generated during the process. As regards the use of asbestos material, the roof of one of the large store (No. 6) is covered with asbestos sheets. There is sign of crack along damaged parts of the roof which is about 1120 m^2 in size.

The facility qualifies for partial audit. Such an audit, based on its findings, may require a full audit.

1.114 Ethiopian Shipping Lines Share Company — Transit

The company was established in 1964. Currently it owns 9 cargo ships. The head office of the company is located in Addis Ababa with overseas representative offices in various port cities in Europe, Middle East and Asia. Regarding environmental issues, the company is operating under MARPOL 78 convention for ocean pollution. It was indicated during the visit that the firm abides by this and other national and international conventions.

As it has no any environmental issue related to Ethiopia, further audit is not recommended.

1.115 Maritime and Transit Service Share Company — Transit

The enterprise was established in 1968 as a clearing, forwarding, shipping agency, as well as to provide associated services. In 1994, the PE was restructured and a number of activities were transferred to Djibouti, where currently, most major activities are carried out. Local activities include booking local shipping agency, container handling, customs clearance, dry cargo transportation, air cargo agency, etc. The local office is an administrative office.

No further audit is needed.

1.116 Sheb-lle Transport Share Company — Transport

The PE was established in 1994. Formerly known as Freight Transport Organization. Its main activity is to provide transport services.

Regarding environmental conditions, all over, the facility's premises is untidy and dirty. For instance, mixtures of gasoline, oil and water used at the facility are not properly drained. The system designed is filled with greasy and oily mud. Also heaps of sludge, often various mixtures, and all kinds of scrap exist everywhere. Some wastewater is discharged to the nearby river.

Based on the field visit and discussions with the staff, a partial audit is recommended.

1.117 Walia Inter City Bus Service Enterprise — Transport

It is one of the three enterprises established in 1994, upon the dissolution of the former holding corporation-Ethiopian Public Transport Corporation. The enterprise with a fleet of 104 buses is engaged in inter-city public transport service. Waliya has two workshops and washing stations in Addis Ababa and six branches at various locations in the country. The enterprise employs 886 people.

Waliya has storage tank for diesel (capacity over 15,000 liters) and petrol (capacity about 10,000 liters). Used oil from the enterprise's fleet is sold off. Wastewater from the washing stations is discharged to the surrounding area and a river nearby.

A partial audit may be necessary to assess this situation.

1.118 Weyra Transport Share Company — Transport

Weyra is one of the five state owned freight transport enterprises established upon the dissolution in 1994 of the Ethiopian Freight Transport Corporation. The company is engaged in tanker fuel cargo freight transport. The company operates a fleet of 74 trucks with trailers; and the principal route that it serves is Djibouti-Addis Ababa.

The company has poor workshop facilities and all working areas are dusty. The fleet of trucks generate annually 3,000-4,000 litres of used oil, which is sold.

There are no significant environmental issues that would warrant further audit.

1.119 Ethiopian Grain Trade Enterprise — Trade

The enterprise is not to be covered because it is no more under PPESA.

1.120 Procurement Service Enterprise — Trade

The enterprise was established in 1992, and it has 50 employees. It is a service rendering enterprise engaged in providing international and local procurement of related services, collect and provide up-to-date international and domestic market information for government offices.

No environmental issue has been observed. Thus, the environmental audit required is the level of only pre-audit.

1.121 Merchandise Wholesale and Import Trade Enterprise — Trade

The enterprise was established in 1993. It has a total of 1614 employees. It is mainly engaged in sale and purchase of goods and commodities, procured locally or from outside. In addition, the PE provides related services.

Regarding environmental issue, some chemicals like LANIRAT for rats, and insecticides like ETHIOZINONBCEC are used for protecting food items in big stores. Workers dealing with the chemicals are well protected and no environmentally significant hazardous situation exists. Oil spills around the garage were observed, but it could be managed by better housekeeping.

Review of the above situation as well as the criteria used for other PEs indicates that no further environmental audit is required.

1.122 ECAFCO Share Company Wood

ECAFCO, is the only factory of its kind in Ethiopia, manufactures chip wood, pre-fabricated housing structures and styrofoam products. The factory was established in 1963. The company is located in Addis Ababa, in the Nefas Silk-Lafto sub-city. The factory also renders Wood Impregnation Services.

ECAFCO's major raw materials are urea, formal-dehyde, eucalyptus logs, timber, Styrofoam chemical, asbestos, and wood impregnation chemicals. It employs 308 people.

As inputs to its products and services, ECAFCO uses a few chemicals including asbestos, which could cause health hazards in its friable form. Recycling at the factory reduces the total quantity of wastes. The chopping machine (to chop logs) in the process plant and the circular saw in the woodworks shop generate high level of noise. Also, the working environment near and around these machines is dusty. Although protective devices including masks and earmuffs, are provided, according to the management, workers do not use them. No oil spills in the factory were observed. The underground fuel storage tanks in the factory compound are checked by Shell every year.

The safety committee set up to carry out the implementation of safety under the directives of the Labor Office. It is a good sign in the context of Ethiopia. However, the committee and management ought to do more so that workers invariably use safety protective devices. Management should also ensure that the environment, particularly in the woodwork's shop is clean.

In view of the chemicals used by the factory and the issues raised above, a partial environmental audit is recommended.

1.123 ETHARSO Factory Wood

Business purpose of the factory mainly concentrates on the production of Hard and Soft Boards These are used for construction and renovation of houses, buildings, and other structure. Acoustic tiles and box files are also manufactured using by-products.

Eucalyptus tree is the only raw material used. It is domestically grown and available. Annual raw material requirement is 9,720 m^3, when the factory is operating at full capacity production. The factory is designed to produce 312,000 pieces of hard and soft board per annum. However, currently a maximum of 218,400 pieces.

Manufacturing process starts by chopping white Eucalyptus tree and finely grinding it. During the process, large quantity of organic dust is given off. Workers are provided with respirators. However, they rarely use it. Water is applied in the process at different stages. It is circulated for reuse. What is left on the surfaces is drained but properly and connected to the main sewer line of the city.

About 31 tons of chemicals are stored in one part of the factory since nationalization of the factory. Effort made by the management to find means of disposing the items failed due to lack of action, disposal facilities and other unknown causes. These chemicals need to be safely disposed off.

Based on field visit and the criteria used for other PEs, a potential audit is recommended.

1.124 Ethiopia Plywood Factory — Wood

The factory was established in 1944 and it has a total of 280 employees. It has a branch factory in Jimma 330 Km from Addis Ababa. The main products are timber, plywood, and household and office furniture.

Dust and noise are common hazards in the industry. Due to the old technology most of the machines have no hoods and exhaust ventilation and some are not functioning properly. Workers were not provided with masks and earmuffs. Oil spillage has been observed in the garage and workshop. No solid or waste hazards generated in the factory.

Due to the environmental conditions observed in the factory, a partial audit is recommended.

1.125 Sawmills and Joineries Enterprise — Wood

The enterprise was established in 1961, and it has a total of 334 employees. The main products are sawn timber, veneer, household and office furniture and wooden construction materials. The enterprise under it has 17 sawmills, tow household and office furniture factories and veneer factory, the only one of its kind in the country.

The most common hazards in the enterprise are noise and dust. Often noise and dust are created by different types of processing machines. Dust is also a common inconvenience factor. It is also a hazard in working environment. The Ministry of Labor inspectors have visited the factory and given recommendations regarding safety and health issues. But workers were not provided with masks and earmuffs.

The environmental audit required is the level of pre-audit.

1.126 Abay Technical Service Enterprise — Metals

It is a service giving enterprise engaged on maintenance, body build up, painting and to sell spare parts for automobiles and trucks. It has 50 employees.

Painting is done in paint room and under well-ventilated rooms including through the use of exhaust hoods. A few spills were noticed oil in the surrounding environment due to poor housekeeping.

Regarding the environment issue the wastewater is discharged untreated to the city drainage system. The facility needs a partial audit.

1.127 Addis Spare Part Import and Distribution Share Company — Metals

Established in 1994 with the purpose of import genuine spare parts for vehicles and trucks of all capacity. Import and sales of spare parts and tyres are major activities of the company. Large and modern stores are available to accommodate more than 8,000 types of spare parts.

Furthermore, the company renders rental services to customers who need: stores, kren, unutilized open space (for parking) and cargo trucks. Activities such as processing, manufacturing and technical workshops do not exist.

Operators and store workers (loaders/unloaders) are given protective equipment where required.

1.128 Akaki Metal Products Factory — Metals

The factory was established in 1964. Currently, it has 270 employees. The factory produces two types of products. Galvanized iron sheets and galvanized pipes. The raw materials used are iron sheets and steel strips. Key chemicals used during manufacturing include hydrochloric acid, galvanizing- zinc, chromic acid, lead, and ammonium chloride. Workers are aware of the forthcoming privatization.

Noise, dust and fumes are the common ones. The factory has been visited by the Factory Inspectors and given directives to safe guard safety and health of workers. Workers are provided with the appropriate chemical proof and dust proof respirators and they wear it. It has been observed that wall mounted ventilators are existing and exhaust the fumes emanating in galvanizing section. But the working environment was seen dusting and full of fumes and smoke.

During the visit, oil spills and noise have been noted in most operating area. The wastewater treatment plant needs re-innovation. Fumes and smokes are also inhaled and can cause damage to the body. Zinc and ammonium chloride are in use in large quantity in all the process.

The environmental issues require a level of pre-audit of the above-mentioned chemicals in use and the fumes and gases they emanate. The wastewater treatment plant should be renovated and maintained.

1.129 Akaki Spare Parts and Hand Tools Share Company — Spare Parts

Akaki Spare Parts and hand Tools Share Company, which started operation in 1989, is located 25 Km from Addis Ababa, adjacent to the main road to Djibouti. The company currently employs 600 people. The company produces spare parts, industrial hand tools, cutlery (forks, spoons, knives) and commercial items like anvils, vices and automotive parts. The company, with annual melting capacity of 4500 tons in 2 shifts, has the requisite machinery for mechanical workshop, foundry, forging, heat and surface treatment jobs.

Some of the chemicals used annually by the company in its various sections are the following: Foundry: Furan Resin (130 tons), catalyst (80 tons). Heat and surface treatment: chromic acid (450 kg), hydrochloric acid (134 kg), sulfuric acid (782 kg), lead (200 kg), Nickel chloride (75 kg), zinc chloride (450 kg) Hydrogen peroxide 930 kg), Nickel Sulfate (500 kg), Trichloroethylene (1447 kg), Nickel (200 kg), Nickel chloride (40 kg). Machine shop-coolant (mostly dromus oil).

The wastewater treatment plant has not been working for about two years. Consequently all of the company's wastewater incorporating the chemicals used are discharged to the surrounding area without treatment. The furnace in the foundry is partly insulated with asbestos. Silica sand (along with resin) waste is piled up in the company compound. According to the management, arrangement for solid waste disposal is being made with City Administration.

The company uses a number of chemicals, the waste of which is discharged untreated. The company does not seem to be taking significant measures to make the environment safe or hazard-free.

The situation, thus, calls for a full audit.

I. 130. Ethiopian Iron and Steel Factory — Metals

The factory was established in 1961. Currently it has 386 employees. The raw materials used to produce iron and steel includes imported prime quality hard steel billets, low-carbon wire rods, Galvanized wires and locally produced ingots from steel scraps. Other products produced include reinforcement bars, iron nails, fencing nets, and barbed wires. Regarding the forthcoming privatization, the workers are well aware of it and seem to be supportive. No hazardous chemicals are used or stored in the factory.

The factory has not been found liable for any type of environmental health and safety violations.

The working environment has noticeable amounts of dust, fumes, noise, and heat. The situation is exaggerated due to the age of various machines, combined with its poor maintenance. The Ministry of Labor and social affairs inspectors have occasionally visited the factory and given directives to reduce the harmful effects. Also, workers are provided with appropriate protective equipment. No asbestos material was found in the factory.

However, oil spills were observed in most working areas. Facility's wastewater is discharged through cement pipes and is charged directly to the nearby river without any form of treatment.

Based on site visit and review of the environmental issues, a full environmental audit is recommended.

I. 131. Ethiopian Plastic Share Company — Plastics

The manufacturing plant of Ethiopia Plastic Share Co. is located in Bole sub-city, woreda 17 and kebele 23. The plant manufactures thermoplastic products for the construction, packaging, textile and household purposes. These include polyethylene bags, detergent bottles, jerry cans, hoses, boots, conduits, and electrical wire insulation. The major raw material used by the plant is polyethylene (low and high-density types).

The raw material used by the company is of good grade. There are no oil spills or storage for fuel. As recycling is a key feature of the plant's process, the waste generated amounts to less than 1%- which is disposed off by the City Administration. The grinding machine that grinds

scraps for recycling generates dust and noise. The management sees to it that workers at recycling section wear masks and earmuffs.

There are no hazardous or toxic chemicals or materials in the plant. However, the disposal of the waste that is generated, though small, according to management and hence a non-liability- may need to be investigated further. Thus, a partial audit is recommended.

1.132 Kombe Metal Products Factory — Metals

It is the first hand tools factory in the country. Its main industrial activity is to manufacture small agricultural and construction hand tools for local market.

Two main raw materials used are steel bars and sheet metals with medium carbon content in order to maintain chemical properties of the required standard. Despite the existing shortage of raw materials and its inadequate level of technology, the factory produces about 21 types of items most of them are highly needed among peasant farmers. Some of the products are shovel, pickaxe, hammer, sickle, machetes, plough, chisel, hoe, garden rack, crow bar, etc.

Steel bars and sheet metals are treated through hot work and cold work process to manufacture the items respectively. Hot work is the use of furnace to obtain red-hot metal ready for mechanical hammering where as cold work is mostly processed by the use of pressing machine.

Smoke and soot are generated heavily from the furnaces. As observed during the visit the internal part of the factory is covered with soot dust mixed with oil. The compound and the surrounding environment do not seem favorable. The nature of the existing technological process allows it to occur. Hence, there is limited opportunity for improvement before modern technology is introduced.

1.133 Kolfe House Hold and Utensils Factor — Metals

The factory was established in 1972, and it has 161 employees. It produces different forms of house utensils using aluminum as a raw material. The production process includes pressing, steaming, polishing and finishing. The chemicals in use are sulfuric acid, nitric acid and caustic soda.

The storage of chemicals is not acceptable; they are stored in a damaged and leaking containers with other materials and goods. Chemicals alone in a concentration or when mixed can cause injury or disease. They may also result in fires and explosions. The working area is too much cramped with raw materials and half-finished products. In general the housekeeping is poor.

Fumes and vapors are given off in the steaming and casting areas. Even though there exist exhaust ventilation, it was observed that the working area as a whole and the roof was found full of some and it spoils the working area by dropping smoking particles on the ground. Dust is given off in large quantity in the polishing machine. The operator is protected with the necessary protective equipment but workers around him are affected by the dust.

Oil spillage has been observed around the furnace tanker, the workshop and the temporary storage tanker at the back of the factory. The wastewater, coming out of the factory, is disposed into the nearest municipal drainage without any form of treatment.

Considering the situations existing in the factory and the backwardness of the technology, the environmental audit requires the level of partial audit.

1.134 Nazareth Tractor Assembly Factory — Metals

The factory was established in 1984. Currently, it has 150 employees. It is mainly engaged in assembling agricultural tractors ranging from 80-105 HP. Most components are produced from Moldova and the domestic share is negligible. The factory produces 150-180 tractors per year.

During the visit oil spills were observed in the assembly section of the factory, and also outside areas. High noise was also noticed in the work areas. Even though workers were provided with earmuffs no one was wearing it at the time of the visit. We were informed that no liability has come to-date from any factory workers, or any other concerned authority. Both the washing and painting is carried out in a well-ventilated room with proper exhaust system, but the KADILAC auto paint has no label. Proper label is essential to identify the contents and to warn people of the hazards. Labeling should be clear and visible and need to be kept wherever the substances are stored or used.

Regarding general safety and health issues, the Ministry of Labor and Social Affairs inspectors have visited the factory, given necessary advice on what measures should be taken to ensure effective protection from hazards in the working environment. Such visits are rare.

Upon inquiry, we were informed that workers are well aware of the forthcoming privatization, and overall are not opposed to it.

No asbestos in friable form seems to exist at the factory.

Regarding the wastewater, there is an underground pipe in which all the wastewater from the factory passes through and accumulated in the settling (septic) tank, from which it is pumped and discharged to the city's drainage system without any form of treatment.

The facility qualifies for a partial audit.

1.135 Zuqnala Steel Rolling Factory — Metals

The enterprise is located in Debre Zeit, 35 Km out of the town. The factory was established in 1997 under "Basic Metals and Engineering Industries" with the intention to support the construction sector at large and medium metal engineering works. Raw material required is imported, 100x100 mm and 3.5 m long steel in billet form. It is classified in two types; mild and high tensile.

Annual billet consumption is about 105,000 tons. Products are: reinforcement steel bars, square sections, angle iron and flat stripes. Re-heat furnace and various heavy machinery and equipment are in the system to produce the products. Oil tankers and feeding pumps are main

components of the furnace to heat the billets at a required temperature, up to 1,400°C for sufficient rolling.

Major inputs in the process are electric power, water, compressed air and heavy fuel oil. The cooling water is designed so as to re-circulate through underground tunnel. Very little amount of impure water is let to enter into the main tank. Sediment mixed with metallic dust particles is piled in the field. Scale and slug removed from the billets during heating process is also collected and is re-melted in Kaliti Metal Factory. Thus, considerable adverse conditions are not observed as regards to pollution problem. Protective equipment for safety is provided where essential. One safety officer is assigned but there is no data as to what extent hazards occur.

As observed, the factory as such does not need further pre-audit.

2. Environmental Pre-audit Information for 20 AfDB Completed PEs

2.1 Fish Production and Marketing Enterprise [illegible]

The firm was established in 1978. At present, it has 234 employees. The key business activities are fish production, fish preparation and fish sales 8-10% of the total production is for export.

Key environmental issues at the enterprise relate to the use of the CFC's, the freon Gas R-22 and R-22 HCFC-22 chlorodifuoromethane for cooling in all the chillers and refrigerators. These substances can harm public health and the environment and are also known for atmospheric ozone depletion. Many countries have discontinued their use, and several substitutes are available in the commercial market. Workers are not aware of their harmful affects and they are not provided with respirators. The amount used for each is very large. The effluents come out of the working process and pass in the open drainage and are discharged in the nearby land without any form of treatment.

The environmental audit requires a partial audit, because the hazardous conditions, which were mentioned above, could easily be solved by changing gas and introducing wastewater treatment.

No further audit is recommended

2.2 Coffee Technology Development and Engineering Enterprise - Ethiopia

CTDEE was established in 1993. Currently, there are 103 employees in the enterprise. The head office for the enterprise is located in Addis Ababa. The enterprise also owns workshops, and store and maintenance facilities in the Saris area of Addis Ababa. In addition the enterprise also owns a branch office workshop in Awasa about 270 km from Addis Ababa.

The main products of the enterprises include manufacture of coffee pulping machines, wooden and metallic office and household furniture and equipment, metallic concrete pipe moulds and metallic panels. The PE also sells spare parts for maintenance of coffee pulping machines and construction equipment. Other activities include construction of buildings, maintenance of rural all weather roads and dry weather access roads and training in the use of various equipment.

The enterprise mainly uses sulfuric acid for car battery charging process. Workers are provided with masks, and most wear them. Workers are also well aware of the forthcoming privatization and are generally supportive of it.

To date, no liability has come from individuals or concerned authorities concerning safety and health violations. No occupational hazards were observed in the workshop during the site visit.

At the workshop, however, in most maintenance areas oil spills were observed. It seemed that no attention is being given to the matter. No asbestos material use was discovered in the workshop. The wastewater from the enterprise is discharged to the nearby land. The effluent is untreated and no analysis is conducted. Regarding environment and occupational safety and health, both the Ethiopian Environmental Authority and the Ministry of Labor personnel have visited the

enterprise workshop concerning their respective areas. Each provided the necessary advice and recommendations for potential implementation.

Given the nature of the operation, the site visit, discussions with the officials, and based on criteria used for other PEs, this facility is recommended for a partial audit.

2.3 Natural Gum Production and Marketing Enterprise — Agriculture

This enterprise was established in 1962. It employs 270 permanent and 3,000 temporary, seasonal workers. The enterprise is engaged in the production and marketing of natural gum. The raw material used is oil or resin extracted from the special trees called *Bosellia Papyrifera* found in the desert areas of the country.

The enterprise has six branch offices. Each of these is engaged in the collection, cleaning and selection process is carried out to produce natural gum.

Gum extraction for the factory occurs in the desert area of Ethiopia. The working environment at these places has dangerous animals and reptiles. This factor as well as deforestation and natural calamities such has forest fires have reduced the quantity of raw materials available. This has often resulted in temporarily shutting off of manufacturing gum. In the cleaning and selection section of the factory, considerable dust was observed. However, the workers are provided with working clothes and masks and they wear it.

A partial audit with a focus on assessing occupational risk to workers is suggested.

2.4 Ethiopia Marble Industry — Construction

The enterprise was established in 1937. It comprises of 3 factories, namely Gullele, Bole and Nefas Selk. It is a processing industry, established to produce and sell marble products. It also provides fixing and installation service to customers.

Raw material used including marble blocks extracted from rocks in quarries located at Harrari and Benshangul regions. Main activities in processing marble are cutting, washing and polishing. Modern and high power machinery is installed to cut the blocks into different sizes and shape to produce marble products, lime stone slabs and various types of tiles used for external and internal wall-cladding, floor covering, stair cases, etc.

The process uses high quantities of water. During the process, the dust turns muddy in the wet process and is drained off through a ditch connected to large size pond constructed in such a way that gradual purification of water and sedimentation of impurities take place allowing for water reuse. Following this, the mud is removed and dumped in the nearby river.

At Nefas silk factory, untreated wastewater is improperly disposed off. Heaps of mud and water are also adversely impacting the roofs and walls of houses located adjacent to the factory. There have been many complaints.

No chemical or biological data on characteristics of marble (dust particles) and other environmental parameters were available or any diagnostic reports from concerned authorities exist. However, comments obtained from management and workers indicate positive attitude arguing that impaired health as a result of dust (of marble) is a hazard of the occupation. However, the management was told during the visit that the existing situation should not go

unattended. This issue requires attention from industrial hygienists as well as FEPA, MoLSA and others.

The PE needs a partial audit.

2.5 Prefabricated Building Parts Construction Enterprises – Engineering

The enterprise was established in 1984. It has 1,202 employees. Raw materials used include cement, aggregate 02, sand, reinforcement bar pre-stressed wire, and others.

There are three bays to produce different types of prefabricated building parts. The enterprise's products can be grouped into three major categories. These are (1) production of floor slab and ceiling in mobile moulds, (2) productions of shear walls and footing stationary moulds and (3) production of columns, public slobs, edge grinders, landing and flight in stationery moulds.

In addition, the factory produces and sells pre-fabricated building parts made from concrete. The PE also provides services for the erection of pre-fabricated building parts. Regarding privatization, workers are well aware of the forthcoming privatization and are open to. To date, the enterprise has not received any liability claims of fines for health and safety violations.

No asbestos materials were found. FEPA personnel have visited the enterprise and given recommendations concerning environmental and health issues. The Enterprise has formed a committee to deal with the matter. The Ministry of Labor inspectors have also visited the factory and given directives in writing as to the needed measures the enterprise should take to improve worker's occupational safety and health. Also, workers are provided with the necessary protective equipments.

At the plant, there are underground storage tanks 20,000 and 3,000 liters, each. They are checked by the petroleum company in charge of it. There is also an underground oil storage tank with a capacity of 15,000 liters. It is owned by the enterprise and no body has checked it for the last fifteen years. It is likely to have leakages. Oil spill was observed around used oil tank. Dust is common problem due to the nature of the activity. The wastewater effluents from all working area pass through the concrete pipe and disposed into the nearby land, owned by the enterprises without any form of treatment.

A partial environmental audit is required. This is based on improper handling of effluent, oil spill and unchecked underground tank at the facility. The dust problem should also get attention and appropriate measures should be taken to reduce the effect.

Based on the review of the situation and criteria used for other PEs, a partial audit is recommended.

2.6 Bahir Ceramic Products Share Company – Ceramics

The company was established in 1996 for the production of ceramic products. It is situated 270 km south of Addis Ababa. It was established on an area of approximately 207,000square meters. The surrounding areas have farming communities. The raw materials used are found

locally. These include Kaolin, feldspar, Quartz, silica sand, mugger clay, zirconium silicates, plastic clay and limestone (total quantity 8012 tons/annum). In addition, imported ball clay, stains, deflucutant, mould-making materials, transferable lithographic and plaster of Paris are also used. Furthermore, key chemicals used include milled zircon, talc, zinc oxide and Barium carbonate (total quantity 596 tons/annum)

The major products produced are Tableware 2,690 tons/year, Sanitary ware 156 ton/year, and wall and floor tiles, approximately 233 sq. mts.

There is no hazardous discharge or any-other significant environmental or health issues. However, some chemicals of unknown composition have been stored at the facility for a long time. In addition, some leftover dust is released after suction by an extractor. A partial audit is suggested. It is also suggested that the stored chemicals be promptly removed, the contents analyzed and safety disposed off. In addition, adequate ventilation should also be provided in all work areas.

2.7 Water Well Drilling Enterprises — Engineering

The enterprise was established in 1975. Currently, it has 216 employees. Its business activities include water well drilling.

Chemicals/solvent Foam from Repi soap factory, Detergent, Bentonile, Hydraulic oils and rock oil is used also for lubricant during drilling, oil spills all over the compound were observed. We were told that they occur regularly and to date no action has been taken to prevent their occurrence. Effluents are discharged by an open drain to the nearby village without any form of treatment. Also, the Case Slotting machine is producing excessive sound where workers were not provided with earmuffs except the operator. In addition, the Case Slotting Machine is emanating irritating gas, spreading fumes all over the working area. Workers are not provided respirators except the operator.

The environmental and worker health situation at the PE requires a partial audit. Based on the environmental issues mentioned above serious corrective measures should also be taken to avoid the situations.

2.8 National Tour Operation Enterprises — Tourism

The enterprise was established in 1983. It employs 150 people. The enterprise is engaged in tour operating and travel agencies. The enterprise provides special interest tours, such as tours to historic places, photo safaris, tours to wild life, birds watching and scenic sites.

The enterprise has well equipped workshop separately from the head office. The observation is mainly based on the workshop conditions. Workers are well aware of the forthcoming privatization.

Sulfuric acid is mainly used for car battery charging process. Workers are provided masks and they wear it. There has been no liability suits from individuals. Also concerned authorities have not cited the enterprise for any regarding occupational safety and health or environmental violations. It was observed that no occupational hazard exists in the workshop.

There is a full station having two tanks with a capacity of 20,000 liter each. The tanks have never been checked by the PE or the concerned authority for leakage. The untreated wastewater is disposed to the nearby land. The Ethiopian Environment Authority and ministry of Labor personnel have visited and given advice and recommendations in their respective areas.

Based on the existing conditions and using the same criteria as has been done for other PES, the enterprise needs a partial audit.

2.9 Ethiopia Rubber and Canvas Shoes Factory — Shoes

The Factory was established in 1967. It has a total of 386 employees. The factory produces canvas shoes, boots, sport shoes, rubber sheets, and unit soles and billiard ring. Raw materials used include natural and synthetic rubber PVC, different types of textiles, poly bags PP woven bags, and shoe eyelets.

A large variety of chemicals are used annually this includes Marepato Bensotbiazole (MBT), 2000 kg; Dibenzothiazy Disulpheid (DM), 650 kg; Dephenyl-Guainidine (DPG), 2000 kg; 4010NA (N-Phony-N-Isopropyl-P. Phenlene Diamine, 1000 kg; "DS" (Mixture of A Ackyl and arackyl Substinaiter panoc's), 500 kg; Insoluble Sulfur (20% Oil Treated), 4200 kg; Zinc Oxide Active, Zinc Oxide Red Seal Normal, 5000 kg; Silicon Oil, 150 kg; Zinc Streate, 6000 kg; Stearic Acid, 2000 kg; Extracting Petrol, 5000 liters; Desmodur, 20 kg; Carbon Black, 5000 kg; Cumaron Resin, 6000 kg; Vulcalent B/C, 250 kg; Titanium Dioxide, up to 2000 kg; and Processing Oil, 5000 liters of these chemicals perform various functions including acting as accelerators, anti oxidants, accelerators, hardeners and fillers, cleaning agents and

Key Environmental issues include oil spills in the maintenance shop and oil store, and use of asbestos sheets for roof covering. Many old asbestos sheets some friable are piled a large number, where there was no awareness of the harmful effects. Also, outdated and different kinds of chemicals are improperly stored in the premises. The containers had or no labels, there by creating potentially serious EHS risks. Also many of the containers are rusty and damaged. Making it is difficult to differentiate between one container from the other. In addition, excessive noise was observed at the facility's rubber compound grinder. Workers are provided with earmuffs but did not wearing it. The effluent comes out from the factory are stored in sedimentary tanks, where filtration takes place. The residues remain there and the untreated wastewater is discharged to nearby land. Given poor or no management, solid waste problem has increased over time together. Incineration is expensive and also causes air pollution.

Environmental audit requires a level of full audit, because environmental issues are many and serious. Also most of them, it seems, are due to poor awareness, lack of technical and management capacity, and other factors. Moreover, the nature of the business uses many hazardous chemicals, which are associated with EHS risks. Therefore, a survey should be carried out with the aim of elaborating a program for the elimination of chemical hazards in production.

2.10 Addvale Soda Ash Share Company — Chemicals

The company was established in 1990 for the production of Soda ash. It is situated about 200 km south of Addis Ababa. It has got a production capacity of 20,000 tons/annum. However, currently it is producing only 9-10,000 tons/annum.

The brine water from Lake Abiyata is used as raw material, The company produce Trona and soda ash with total alkalinity of < 94%

The operation does not generate harmful pollution. Moreover, no environmental health and safety issues of significance were found. Hence no further audit is needed.

2.11 Ethiopian Mineral Development Share Company — Minerals

Established in 1995 with objective to explore and evaluate mineral deposits with in a given location. Also engaged in production and sales of mineral commodities.

Main Products: Tantalem concentrates are produced at kenticha development unit. Kaoline, quartz, Dotomite are produced at Bombawha unit both places located in southern part of the country.

Facilities: cove drilling equipment, heavy earth-moving machinery, Geophysical equipment etc. Diseal generators, maintenance workshops are also among input required in the exploration and production of the minerals.

According to briefings given by the concerned person here at the head office, the process does not involve hazardous condition not produce pollutants which affect the environment. However in circumstances where the use of protective equipment is essential, it is accordingly provided solid waste deposited during the process is dumped in deep pits left on fields throughout exploration. He said there is no issue of environmental problem.

Based on the discussions and assessments made, the facility requires no further audit.

2.12 Artistic Printing Enterprise — Printing

Artistic Printing Enterprise was established in 1931. It is engaged in printing miscellaneous products like books, magazines, labels, posters, soft paper, diaries, brochures, business forms, vouchers, etc. Modern printing technology is introduced to obtain quality products.

Major inputs are paper, ink, binding materials, plates, film developing items and various auxiliary items essential in printing process. Quantity of materials used in a given period is dependent on variation of boom season and recessionary period.

A number of chemicals and petroleum products of unknown composition exist. These have been stored for about 40 years. There are no documents available as to their chemicals or use for printing. It is likely that they contain Polychlorinated Biphenyls (PCBs), which are known for their persistence, toxicity and carcinogenicity. This creates an environmentally serious situation. All four enterprises have more or less similar environmental problems as a result of wastewater disposal. At Yekatit Paper Converting enterprise, untreated water is drained in to an open channel through the residential areas. The channel runs larger than 2 km through market areas. There is information that complaints are often forwarded from the public to the attention of the management. Thus, conditions seem more neglected.

Artistic printing enterprise also suffers pollution of wastewater drained into its compound from neighboring residents. While Artistic complained, the surface water drainage from the

neighbors has not stopped. The existing concrete pipe needs to be restructured to partially correct the problem. Nevertheless, to date, no liability issues have been raised.

In letterpress printing technology applied in most printing enterprises, figures of letters are formed to obtain shape by casting in the lead mould. Melted again and again for reuse after a given printing activity is completed. In this course, contamination of lead dust is possible. Mixed with combined dust and with wastewater drained off untreated.

The review indicates that a partial audit is required.

2.13. Bole Printing Enterprises — Printing

The enterprise was established in 1957. The enterprises is engaged in printing miscellaneous products like books, magazines, labels, posters, soft paper, diaries, brochures, business forms, vouchers, etc. Modern printing technology is introduced to obtain quality products.

Major inputs are paper, ink, binding materials, plates, film developing items and various auxiliary items essential in printing process. Quantity of materials used in a given period is dependant on variation of boom season and recessionary period.

All four enterprises have more or less similar environmental problems as a result of wastewater disposal. At Yekatit Paper Converting enterprise, untreated water is drained in to an open channel through the residential areas. The channel runs larger than 2 kms through market areas. There is information that complaints are often forwarded from the public to the attention of the management. Thus, conditions seem more neglected.

In letterpress printing technology applied in most printing enterprises, figures of letters are formed to obtain shape by casting in the lead mould. Melted again and again for reuse after a given printing activity is completed. In this course, contamination of lead dust is possible. Mixed with combined dust and with wastewater drained off untreated.

The review indicates that a partial audit is required.

2.14. Commercial Printing Enterprise — Printing

The enterprise was established in 1939. It is engaged in printing miscellaneous products like books, magazines, labels, posters, soft paper, diaries, brochures, business forms, vouchers, etc. Modern printing technology is introduced to obtain quality products.
Major inputs are paper, ink, binding materials, plates, film developing items and various auxiliary items essential in printing process. Quantity of materials used in a given period is dependant on variation of boom season and recessionary period.

All four enterprises have more or less similar environmental problems as a result of wastewater disposal. At Yekatit Paper Converting enterprise, untreated water is drained in to an open channel through the residential areas. The channel runs larger than 2 km through market areas. There is information that complaints are often forwarded from the public to the attention of the management. Thus, conditions seem more neglected.

In letterpress printing technology applied in most printing enterprises, figures of letters are formed to obtain shape by casting in the lead mould. Melted again and again for reuse after a given printing activity is completed. In this course, contamination of lead dust is possible. Mixed with combined dust and with wastewater drained off untreated.

The review indicates that a partial audit is required.

2.15 Yekatit Paper Converts Enterprises — Paper and Printing

The enterprise was established in 1957. It is engaged in printing miscellaneous products like books, magazines, labels, posters, soft paper, diaries, brochures, business forms, vouchers, etc. Modern printing technology is introduced to obtain quality products.

Major inputs are paper, ink, binding materials, plates, film developing items and various auxiliary items essential in printing process. Quantity of materials used in a given period is dependent on variation of boom season and recessionary period.

The enterprise has more or less similar environmental problems as with other printing enterprises.

In letterpress printing technology applied in most printing enterprises, figures of letters are formed to obtain shape by casting in the lead mould. Melted again and again for reuse after a given printing activity is completed. In this course, contamination of lead dust is possible. Mixed with combined dust and with wastewater drained off untreated.

The review indicates that a partial audit is required.

2.16 Adei Ababa Yarn Share Factory — Textile

Adei Ababa Yarn Factory Untreated Wastewater Discharged to Open

The company was established in 1961 and is located in Addis Ababa. It is engaged in the spinning of various counts of cotton yarn, weaving of acrylic blankets and stitching of garments from woven and knitted fabrics. It has also a dyeing plant for knitted fabrics where several types of chemical dyestuffs and auxiliaries are used.

Adei Ababa Yarn Factory Leaking Furnace Oil

The mill discharges its untreated water from the dye house directly to the city drainage system. Beside this Adjoining wood factory called ECAFCO, a government owned factory, is not only polluting the air through uncontrolled (saw) dust but also damaging the Adei mills work environment. This dust also settles on the mill machinery. Complaints to the government have not brought any result. Based on the visit, the factory needs a full environmental audit.

2.17 Ethiopia Fiber Products Factory — Textile

The factory was established in 1940, currently, it has over 1143 employees. Raw material are jute fiber, local fiber, the main product are sacks and thread. Workers are well aware of the forthcoming privatization; no liability has been made so far from individuals regarding occupational safety and health violations. Also the operation does not seem to present any

occupational hazards. The factory uses organic material, which does not contribute to adverse health effects. The Ministry of Labor inspectors have visited the factory and have made recommendation concerning safety and health matter. The factory provides the necessary protective device based on the recommendation on the collective agreement. No oil spills, No liquid wastes, solid wastes, smokes and fumes were affecting the environment, were observed.

The environment audit requires only pre-audit because of the safe and no urgent problem affects the environment.

2.18 Debre Berhan Blanket Factory — Textile

The factory was established in 1964 and it has 846 employees. The main products are blankets, finished cloth, and carpets from wool or synthetic, cotton fibers and filaments. The major raw materials are locally available cotton yarn, nylon ribbon, label and sewing thread. The factory uses formic acid and sodium acetate. In addition, sulfuric acid and trisodium phosphate are rarely used. Dyestuffs like basic dyes and direct dyes are also used.

Hazardous chemicals are in use in many processes like dying machines, but there are exhaust ventilation and hoods mounted on the machine to prevent the hazard. Besides workers were provided with masks. Noise was also common in some processes, but I have been informed that the level of noise has never exceeded the permissible level of 90 DBA. Here also workers are provided with earmuffs. Ethiopian Environmental and Ministry of Labor and Social Affairs personnel have visited the factory and given the necessary recommendations in their respective area. It was observed that the recommendation given by the authorities has helped them so much in improving the general environment and safety and health conditions. Asbestos material in friable form seems to exist in the factory for insulation purpose around the boiler. It has been observed that no attention was given to the problem.

Dust is common in bell opening process. Workers were given masks and they wear it. Oil spills were observed around the furnace tanker and garage. Regarding effluent discharge, all the wastewater comes out from the working process pass the filtering process where the solid material is removed and taken to other place while the untreated wastewater is disposed to the nearby river. According to the Ethiopian Environment Authority report the pH value is 7. However, the factory has started building wastewater treatment plant. The construction of the house and settling tank has been completed. I have been informed that the company is waiting the arrivals of the necessary machines and solve the problem crated by leakage of water from the nearby river into the new settlement tank.

Due to the existing conditions mentioned above, the environmental audit requires a level of partial audit.

2.19 Midroc Sheet Products Factory — Textile

The factory was established 1945. It has over 1,200 employees. Jute is used as the major raw material to produce sacks and threads. Workers are aware of the forthcoming privatization but have negative attitude due to job security reasons. No oil spills or chemicals were observed during site visit. Dust is a common inconvenience in this type of work, but due to the organic nature of the raw material and the personal protective equipment provided to the workers, any harmful effects are minimized. The small quantity of effluent comes out of the factory

through open drains. It is disposed to the nearby land without any form of treatment. Overall, the visit indicates that ESH impacts caused by the operation are insignificant.

A partial environmental audit, with a focus on the effluent handling system at in the factory is recommended.

2.20 Kaffi Metal Products Factory — Metals

The factory was established in 1940. Currently it has over 1143 employees. The raw material is jute locally produced. The main products are sacks and threads.

Regarding environmental issues the factory were using organic materials, which are not harmful to health. The ministry of labor personnel have visited and given Recommendations concerning healthy and safety issues. It has been observed that workers were provided with the necessary protective equipment. No wastewater discharge and asbestos material used.

The environment audit required is only the level of pre-audit.

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Table No.: **Ethiopian Tanners Association Proposed Emission Limited Values For Discharges to Water Based on Tanning Industry's Current Experience With the Facility of Primary Effluent Treatment Plant (ETP)**

Comparative Discharge Limits for Wastewater Discharges			
No.	Constituent Group (Parameter)	Emission Limit Value (Mg/1) Proposed by FEPA	Emission Limit Value (Mg/1) Proposed by ETA
1	Temperature	40^0C	40^0C
2	pH	6-9 pH units	6-10
3	BOD_5 at 20^0C	> 90% Removal or 200 mg/1	50% Removal or 1500 mg/1
4	Chemical Oxygen Demand (COD)	500	50% Removal or 2500 mg/1
5	Suspended Solids	50	200
6	Total Ammonia (as N)	30	250
7	Total Nitrogen (as N)	>80% Removal or 60 mg/1	50% Removal or 150 mg/1
8	Total Phosphorous	>80% Removal or 10 mg/1	N.D
9	Oils, Fats, and Grease	15	15
10	Mineral oil (interceptor)	20	N.D
11	Chromium (as total Cr)	2	2
12	Chromium (as Cr VI)	0.1	0.2
13	Chloride (as Cl)	1000	2500
14	Sulphide (as S)	1	3
15	Phenols	1	N.D
Emission Limit Values for Emissions to Air			
	Substance	Concentration Limit (mg/Nm^3)	
1	Total Particulate	50	N.D
2	VOC_s (degreasing)	50	N.D
3	VOC_s (finishing)	75g/m2 product produced	N.D
4	Total Hydrogen Sulfide, sulfides and mercaptants (as S)	5 ppm v/v	N.D
5	Amonia	40 ppm	N.D
6	Acid vapours (as HCL)	30	N.D

Legend

- N.D : Not Determined
- ETA: Ethiopian tanner association
- EPA: Environmental protection Authority

Appendix B

Environmental Aspects of Key Industrial Sectors

The site inspection of various PEs indicates that a large number of environmental contaminants posing potentially serious environmental, health and safety (ESH) risks lurk in the working environment for majority of the factory workers. While listing of all contaminants and describing each is beyond the scope of this study, to highlight their potential, a few widely spread contaminants, as observed during visit to various PEs, are synopsized as below.

1.1 Key Pollutants

a. PCBs, Asbestos, and Used oil

PCBs

Polychlorinated biphenyls are a group of synthetic organic chemicals that contain 209 individual compounds (known as congeners) with varying harmful effects. There are no known natural sources of polychlorinated biphenyls in the environment. PCBs are either oily liquids or solids, and are colorless to light yellow in color. They have no known smell or taste. PCBs enter the environment as mixture containing a variety of individual components and impurities. The chlorinated biphenyls may be substituted by chlorine in a number of ways, and the group is generally referred to as polychlorinated biphenyls (PCBs).

The polychlorinated biphenyls have been used in a wide variety of applications, including transformer oils, hydraulic fluids, plasticisers, 'kiss-proof' lipsticks and carbonless copy papers. They have also been used in capacitor dielectrics, heat transfer fluids, lubricating and cutting oils, and in paints and printing inks. Within the European Community, PCBs are regarded as "blacklist substances" although no regulatory directive has yet been proposed. PCBs are also included in the proposed UK "red list". The US Toxics Substances Control Act (TOSCA) designates wastes containing greater than 50 ppm PCBs are designated as hazardous.

PCBs, Asbestos and unhealthy combustion of used oil (for process heat) are major polluters at a number of (non-textile) PE's visited during the course of this study. Given this situation and a serious lack of knowledge about these pollutants at the various PE's visited, it is hoped the information provided below would be useful.

PCBs can be absorbed through the skin as well as through ingestion and inhalation. For the general population today, food is generally the primary source. A large range of symptoms of PCB toxicity have been reported, including reproductive and developmental toxicity and immunosuppression. Some congeners, or their metabolites, also exhibit endocrine disruption, including both oestrogenicity and anti-oestrogenicity.

These compounds have been used in a wide variety of applications, including transformer oils, hydraulic fluids, in capacitor dielectrics, heat transfer fluids, and lubricating oils, and in paints and printing inks. PCBs have always been sold as technical mixes rather than individual chemicals, and the Aroclor range manufactured by Monsanto was probably the

most widely used. The most important PCB applications in tonnage terms were transformer oils and capacitors.

Asbestos

Asbestos are very strong and resistant to heat and chemicals. For this reasons asbestos was added to many older building materials including floor tiles, ceiling tiles, insulation on pipes and ducts, acoustical and decorative coatings, and roofing materials. These types of building materials are presumed to contain asbestos if installed before 1980, unless testing has proven otherwise. When left intact and undisturbed, these materials do not pose a health risk to building occupants. There is a potential for exposure only when the material becomes damaged to the extent that asbestos fibers become airborne and are inhaled. Asbestos is more likely to release fibers when it is friable. The term friable means the material can be easily crumbled. If powdered or friable forms of asbestos are disturbed and become airborne, an inhalation hazard may result. In no-friable materials like floor tile, ceiling tiles, laboratory cabinet tops, and caulks, the asbestos fibers are tightly bound in a matrix which prevents the release of fibers to the environment unless the material is abraded, sanded or sawed.

If exposed to asbestos, several factors may influence whether harmful health effects will occur. These factors include the dose (how much), the duration (how long), and whether or not you smoke. Generally, adverse health effects from asbestos are the result of long-term exposure to high concentration of airborne fibers. According to the EPA, airborne asbestos levels in buildings are typically very much lower than those identified in industrial work places where asbestos health effects have been observed. People, who have been exposed to asbestos and are also exposed to cigarette smoke, have a greater risk of developing lung cancer than someone who does not smoke.

Used Oil

Used Oil is defined by the US Environmental Protection Agency (USEPA) as any oil that has been refined from crude oil or any synthetic oil that has been used and as a result such use is contaminated by physical or chemical impurities. During normal use, impurities such as dirt, metal scrapings, water, or chemicals can get mixed in with the oil, so that in time the oil no longer performs well.

However, oils used as lubricants, hydraulic liquids, heat transfer fluids, buoyant, and for other similar purposes are considered used oil. Unused oil such as bottom clean-out waste from virgin fuel oil storage tanks or virgin fuel oil recovered from a spill; do not meet EPA's definition of used oil because these oils have never been "used". Used oil also contains various contaminants. Key ones are listed in the Table 1.

TABLE 1: Allowable levels of Arsenic in Used Oil

Constituent	Allowable level
Arsenic	5 ppm maximum
Cadmium	2 ppm maximum
Chromium	10 ppm maximum
Lead	100 maximum
Flash point	100 degress F Minimum
Total halogens	4,000 ppm maximum

Reference: U.S Environmental Protection Agency

Many PEs in Ethiopia burn used oil to generate industrial heat. Unfortunately, old, obsolete furnaces commonly used at most PEs visited do not efficiently use chemical energy contained in the fuels such as waste oil. To the extent possible, thermal energy contained in the fuel gases should be used. This can be achieved by minimizing heat losses such as through the use of insulation and other measures. Also, most of this use is unregulated and environmentally unsound. Often large leaks were detected around the furnaces. Trucks bringing used oil (mostly from Djibouti) often discharge this oil in above ground containers- the discharge process, it seems, often spills oil, as evidenced from old oil spills.

1.2 Key Industrial Sectors

a. Textiles

The textile industry uses vegetable fibers such as cotton; animal fiber such as wool and silk; and a wide range of synthetic materials such as nylon, polyester, and acrylics. The production of natural fibers is approximately equal in amount to the production of synthetic fibers. Polyester accounts for about 50% of synthetics.

The stages of textile production are fiber production, fiber processing and spinning, yarn preparation, fabric production, bleaching, dyeing and printing, and finishing. Each stage generates wastes that require proper management.

Textile production involves a number of wet processes that may use solvents. Emissions of volatile organic compounds (VOCs) mainly arise from textile finishing, drying processes, and solvent use. VOC concentrations vary from 10 milligrams of carbon per cubic meter (mg/m^3) for the thermo-sol process to 350 mg carbon/m^3 for the drying and condensation process. Process wastewater is a major source of pollutants. It is typically alkaline and has high BOD – from 700 to 2,000 milligrams per liter (mg/l) – and high chemical oxygen demand level. Wastewater also contains solids, oil, and possibly toxic organics, including phenols from dyeing and finishing and halogenated organics from processes such as bleaching. Dye wastewaters are frequently highly colored and may contain heavy metals such as copper and chromium. Wool processing may release bacteria and other pathogens. Pesticides are sometimes used for the preservation of natural fibers, and these are transferred to wastewaters during washing and scouring operations. Pesticides are used for use for synthetic fabrics, and isocyanates are used for lamination. The use of pesticides and other chemicals that are banned should be discouraged. Wastewaters should be checked for pesticides such as DDT and PCP and for metals such as mercury, arsenic, and copper.

Air emissions include dust, oil mists, acid vapors, odors, and boiler exhausts. Cleaning and production changes result in sludges from tanks and spent process chemicals, which may contain toxic organics and metals.

Pollution prevention programs should focus on reduction of water use and on more efficient use of process chemicals. Process changes might include the following:

- Match process variables to type and weight of fabric (reduce waste by 10-20%).
- Manage batches to minimize waste at the end of cycles.
- Avoid non-degradable or less degradable surfactants (for washing and scouring) and spinning oils.
- Avoid the use, or at least the discharge, of alkyl phenol ethoxylates. Ozone-depleting substances should not be used, and the use of organic solvents should be minimized.

b. Cement Manufacturing

The preparation of cement involves mining; crushing, and grinding of raw materials (principally limestone and clay); calcining the materials in a rotary kiln; cooling the resulting clinker; mixing the clinker with gypsum; and milling, storing, and bagging the finished cement. The process generates a variety of wastes, including dust, which is captured and recycled to the process. The process is very energy-intensive, and there are strong incentives for energy conservation. Gases from clinker cooler are used as secondary combustion air. The dry process, using pre-heaters and pre-calipers, is both economically and environmentally preferable to the wet process because the energy consumption - 200 joules per kilogram (J/kg), is approximately half that for the wet process.

Certain solid waste products from other industries, such as pulverized fly ash (PFA) from power stations, slag, roasted pyrite residues, and foundry sand, can be used as additives in cement production.

The generation of fine particulates is inherent in the process, but most are recovered and recycled. Approximately 10-20% of the kiln feed can be suspended in the kiln exhaust gases, captured, and returned to the feed. Other sources of dust emissions include the clinker cooler, crushers, grinders, and materials-handling equipment. When the raw materials have high alkali or chloride content, a portion of the collected dust must be disposed of as solid waste, to avoid alkali buildup. Leaching of the dust to remove the alkali is rarely practiced. Grinding mill operations also result in particulate emissions. Other materials-handling operations, such as conveyors, result in fugitive emissions.

Ambient particulate levels (especially at sizes less than 10 microns) have been clearly demonstrated to be related to health impacts. Gases such as nitrogen oxides (NO_x) and sulfur oxide (SO_x) are formed from the combustion of the fuel (oil and coal) and oxidation of sulfur present in the raw materials, but the highly alkaline conditions in the kiln can absorb up to 90% of the sulfur oxides. Heavy metals may also be present in the raw materials and fuel used released in kiln gases. The principal aim of pollution control in this industry is to avoid increasing ambient levels of particulates by minimizing the loads emitted.

Cement kilns, with their high flame temperatures, are sometimes used to burn waste oils, some hazardous wastes solvents, and other organic wastes. These practices can result in the release of toxic metals and organic. Cement plants are not normally designed to burn wastes, but if such burning is contemplated, technical and environmental acceptability needs to be demonstrated. To avoid the formation of toxic chlorinated organic from the burning of organic wastes, air pollution control devices for such plants should not be operated in the temperature range of 230 - 400°C.

Mechanical systems such as cyclones trap the larger particulates in kiln gases and act as pre-conditioners for downstream collection devices. Electrostatic precipitators (ESPs) and fabric filter systems (bughouses) are the principal options for collection and control (achieving over 99% removal efficiency) of fine particulates. ESPs are sensitive to gas characteristics, such as temperature, and to variation in voltage; bughouses are generally regarded as more reliable. The overall costs of the two systems are similar. The choice of system will depend on flue gas characteristics and local considerations.

Both ESPs and bughouses can achieve high levels of particulate removal from the kiln gas stream, but good operation and maintenance are essential for achieving design specifications.

Two significant types of control problem can occur: (a) complete failure (or automatic shutoff) of systems related to plant shutdown and start-up, power failures, and the like, leading to the emission of very high levels of particulates for short periods of time; and (b) a gradual decrease in the removal efficiency of the system over time because of poor maintenance or improper operation. The lime content of raw materials can be used to control sulfur oxides.

c. Tanning /Leather

Ethiopia, which is endowed with large livestock resources, could make considerable contributions towards the development of leather industry in Africa. With 40.9 million cattle, the country is the first in Africa and among the leading countries in the world in cattle population. Its sheep and goat resources are estimated to be 25.5 and 23.4 million, respectively.

Most of Ethiopia's exports in the leather and leather products sector are semi-processed and processed hides and skins in the form of pickled sheep skin, crust sheep skin, wet blue goat skin, crust goat skin, crust cow hides. The production of hides and skins is very low as compared to its potential. So far the country has been able to produce only 2.4 million hides and 8.3 million sheepskins and 7 million goatskins annually at the kill rate of seven percent, 33 percent, and 37 percent respectively.

The number of tanneries and leather and leather products manufacturing industries in Ethiopia is small as compared to the country's potential. There are about 20 tanneries and 50 footwear companies in the country. Moreover, these factories are said to have lacked entrepreneurial knowledge, and modern technology, among others.

However, even under this situation, the leather and leather products are still the second most important items next to coffee in the country's export with a share of 9.7 percent and 17.2 percent to the total foreign exchange earnings from the country's export in 2003/04 and in 2000/01, respectively.

Through process of tanning, animal hides are converted into leather. The hides, after removal of flesh and fat, are treated with chemicals that cross-link the microscopically collagen fibers and prevent biological, chemical and thermal degradation. The resulting material is strong, durable, and flexible, and can be further processed according to the intended end use, i.e., trimming, dying, buffing and surface coating. Accordingly, there is no single process for producing leather, and many different wastes are generated from each stage. These include include surplus, spent or washed-out chemicals; volatile sulfide and solvent vapors; animal residues from operations such as cleaning, scraping, splitting and trimming, and sludge resulting from wastewater treatment processes or collection facilities.

The composition of a combined tannery effluent that has not been treated is characterized by a high oxygen demand, high salt content, high solids content, high sulfide content, and possibly a high level of chromium. Usually it is also strongly alkaline, with a pH 9 or above. It is, therefore, crucial that tannery wastewater is properly handled and environmentally disposed. The following are the key process steps that are followed in the tannery. This information is provided to help Ethiopia's tanneries achieve a better environmental audit for an industry known for its adverse environmental impacts.

It has been shown that pollution from tanneries is both varied and considerable, involving substantial chemical usage and the copious generation of effluents and solid wastes. Detrimental health and environmental impacts resulting from these processes can, therefore, only be removed if cleaner practices, involving the use of non-toxic and/or biodegradable chemicals are used, coupled with efficient and effective treatment technology, and the assurance and practice of worker safety. With the right combination of technology and organization, with sufficient guidance from the authorities such as FEPA and environmental authorities and with good backup from the tanning industry (See Appendix Table ---), an environmentally sound basis for tanning operations is achievable. However, a reduced input from any of these sectors will require disproportionate contributions from the others, threatening the attainment of these environmental goals.

The tanning industry is amongst the most polluting industries in Ethiopia. In addition to the traditional air and water pollution problems attributed to tanneries, the increasing used of chemicals has the strong potential to lead to serious land and groundwater contamination.

Chromium (Cr) salts are the most commonly used tanning agents. Cr is a controversial chemical on account of its persistent nature and the potential toxicity of some of its chemical forms. Depending on its chemical state, it has various impacts on humans, aquatic life and terrestrial plants. Cr (VI) compounds, for example, are classified as carcinogenic by the International Agency for Research on Cancer (IARC). Occupational exposure to Cr and other toxic chemicals used in tanneries may occur through both direct skin contact and inhalation of vapors and leather dusts. Like most heavy metals, Cr can accumulate in the environment and enter human food chain. Ingesting higher levels than those recommended over a long period of time can result in adverse health effects including gastro-intestinal irritation, stomach ulcers, kidney and liver damage. The toxic metal chromium is one of the commonest and most damaging of the environmental pollutant associated with the tanning industry.

A wide variety of alternatives tanning materials are available. Examples include titanium and vegetable tanning agents. It is the lack of familiarity with such alternatives that has inhibited their widespread adoption to date.

d. Breweries Industry

Beer is an important industry for Ethiopia. From the EHS aspects, it also needs careful attention. Given this situation; it is important to characteristics of brewery wastes. A synoptic view is presented below.

Beer is a fermented beverage with low alcohol content made from various types of grain. Barley predominates, but wheat, maize, and other grains can be used.

Water consumption for breweries is high and ranges from 4-8 cubic meters per cubic meter (m^3/m^3) of beer produced.
Breweries can achieve an effluent discharge of 3-5 m^3/m^3 of sold beer (exclusive of cooling waters). Untreated effluents typically contain suspended solids in the range 10-16 mg/liter, biochemical oxygen demand (BOD) in the range 1,000-1,500 mg/l, chemical oxygen demand (COD) in the range 1,800-3,000 mg/l, and nitrogen in the range 30-100 mg/l. Phosphorus can also be present at concentrations of the order of 10-30 mg/l.

Effluents from individual process steps are variable. For example, bottle washing produces a large volume of effluents that, however, contains only a minor part of the total organics

discharged from the brewery. Effluents from fermentation and filtering are high in organics and BOD but low in volume, accounting for about 3% of total wastewater volume but 97% of BOD. Effluent pH averages about 7 for the combined effluent but can fluctuate from 3 to 12 depending on the use of acid and alkaline cleaning agents. Effluent temperatures average about 30°C.

Solid wastes for disposal include grit, weed seed, and grain of less than 2.2 millimeters in diameter, removed when grain is cleaned; spent grain and yeast; spent hops; broken bottles or bottles that cannot be recycled to the process; and cardboard and other solid wastes associated with the process, such as kieselguhr (diatomaceous earth used for clarifying).

Breweries do not discharge air pollutants, other than some odors. The World Bank group assistance requires that the following effluent levels for direct discharge to surface waters from breweries be attained. Given the lack of data, these levels could not be compared for Ethiopian breweries.

Table . **Effluents from Breweries**
(Milligrams per liter, except for pH and temperature)

Parameter	Maximum Value
pH	6-9
BOD	50
COD	250
DTSS	50
Oil and grease	10
Ammonia nitrogen	10
Phosphorus	5
Temperature increase	≤3°C

Note: Effluent requirements are for direct discharge to surface waters.

Odor emissions from the brewery can be minimized if exhaust vapors are considered before they are released to the atmosphere or if vapors are sent to the boiler and burnt.

e. Glass Manufacturing

Manufacture of flat glass and pressed and blown glass includes plate and architectural glass, automotive windscreens, and mirrors. Pressed and blown glass includes containers, machine-blown and hand-blown glassware, lamps, and television tubing. In both categories, a glass melt is prepared from silica sand, other raw materials such as lime, dolomite, and soda, and cullet (broken glass). The use of recycled glass is increasing. It reduces the consumption of both raw materials and energy but necessitates extensive sorting and cleaning prior to batch treatment to remove impurities.

For the manufacture of special and technical glass, lead oxide, potash, zinc oxide, and other metal oxides are added. Refining agents include arsenic trioxide, antimony oxide, nitrates, and sulfates. Metal oxides and sulfides are used as coloring or discoloring agents.

Waste Characteristics

In all cases, the concentration of heavy metals and other pollutants in the raw flue gas mainly depends on the type of fuel used, the composition of the feed material, and the portion of recycled glass. High input of sulfates or potassium nitrate may increase emissions of sulfur dioxide and nitrogen oxides, respectively. Where nitrate is used, more than two thirds of the introduced nitrogen may be emitted as nitrogen oxides. The use of heavy metals as coloring or discoloring agents will increase emission of these metals.

The World Bank wastewater limits for glass manufacturing industry.

Table 2. Effluents from Glass Manufacturing
(Milligrams per liter, except for pH)

Parameter	Maximum Value
pH	6-9
TSS	50
COD	150
Oil and grease	10
Lead	0.1
Arsenic	0.1
Antimony	0.5
Fluorides	20
Total metals	10

Note: Effluent requirements are for direct discharge to surface waters.

Air Pollution

During the pre-audit, a wide variety of airborne pollutants were of concern from the point of view of health and environmental impacts. This is because a number of health problem have typically been associated with airborne particulates, measures of which include total suspended particulate (TSP) and particulate matter of 10 microns or less in diameter (PM_{10}, the more damaging, smaller particles), and with ambient lead. Damage to structures, forests, and agricultural crops tend to be primarily linked with sulfur dioxide and with ground-level ozone. A number of PEs under the current study use sulfur and its various compounds. In the air, according to the World Bank, Concentrations above 1,000 micrograms per cubic meter, measured as a 10-minute average are considered harmful. A notable example is the Wonji Sugar Factory, near Nazareth. The following table shows the air emission limits established by the bank.

Table : Emission Limit Values for Emissions to Air

Substance	Concentration (mg/Nm^3)
Total Particulates	150
Sulfur Dioxide (as SO_2)	1000
Nitrous Oxide (as NO_2)	2000

Water Pollution

Industrial (and agricultural) chemicals and organic pollutants from various industries are significant source of surface water and groundwater pollution. Acidification of surface waters from air is a threat to aquatic life pollution. To assess the water quality, two broad measures of water quality are widely used: oxygen levels or demands in the water, and concentration of

heavy metals. A measure of pollutant concentrations could be regarded as a pressure when measured in a stream that feeds into a lake or as a state when measured in the water body fed by the stream. Used together, these indicators provide a rough but useful picture of the overall health of the water body and of the threats to it.

A number of PEs under the current study are discharging untreated wastewaters to nearby water bodies, without any regard to the environment. Thus situation needs an urgent attention. The following table indicates the water quality limits established by the World Bank.

Table : Emission Limit Values for Discharges to Water

Constituent Group of Parameter	Limit Value mg/l
pH	6-9 pH units
BOD_5 at 20°C	25
COD	150
Total Phosphorus (as P)	5
Suspended Solids	50
Mineral Oil (interceptors)	20

(Reference: Pollution Abatement Handbook, The World Bank)

Traditionally, primary sedimentation tanks are the most common form of primary treatment. Always placed after a screening of grit removal process, a primary sedimentation tank settles suspended solids from the wastewater flow. As the wastewater flows into a sedimentation tank, the liquid flows very slowly, and the inert and organic solids settle to the bottom. The process theory is the same as for a grit chamber, except that the overflow rate is lower, allowing some of the organic solids, which are less dense than grit, to settle out. The overflow rate is lower, allowing some of the organic solids, which are less dense than grit, to settle out. The solids that settle on the bottom are scraped to a central point and then drawn out by a sludge pump. Wastewater scum, which is primarily oil and grease, is less dense than the wastewater and floats to the surface. Like the sludge, the scum is also collected by a mechanical arm and periodically drawn off.

Appendix: TABLE No: STANDARDS FOR EFFLUENT DISCHARGE INTO THE SEWER OR SURFACE RECIPIENT

COUNTRY	pH	SS mg/1	BOD5 mg/1	COD mg/1	S2- mg/1	Cr6+ mg/1	Cr3+ mg/1	SO42- mg/1	Cr mg/1	TDS mg/1	Phenols mg/1	NH4+ mg/1	O & G mg/1
AUSTRIA													
surface	6.5-8.5	30	30	200	0.5	0.1	1				0.5	0.5	20
sewer	6.5-9.5				2	0.1	4	200			0.5	20	100
GERMANY													
surface	6.5-8.5	20-25	20-25	200	1	0.05	1						5
sewer	6.5-8.5				2	0.5		600	600				50
HUNGARY													
surface	6.5-10			50-150	0.1-0.5	0.5-1	5.0-9.0						
sewer	6.5-10				1	1	5						
ITALY													
surface	5.5-9.5	80	40	160	1	0.2	2	1000	1200		0.5	15	20
sewer	5.5-9.5	200	250	500	2	0.2	4	1000	1200		1	30	40
SYRIA													
surface													
sewer	6.0-10	500	1000	3000	3	0	5	1000	3000				
INDIA													
surface		100	30	250	2	0	2	1000					5
sewer		100	250	500	2	0	2	1000					50
NEPAL													
surface	5.5-9.0	30-200	30-100	250	2	0.1					3		10
sewer													
CHINA													
surface	6.0-9.0	80	30	100	1		1.5				0.5	1	20
sewer	6.0-9.0	200	150	300	2		1.5				2		100
UK													
surface	6.0-9.0	30-50	20-30		1	0.1	2.0-5.0		4000			10	
sewer	6.0-9.0	500-1000		2000-6000	2.0-5.0	0.1	10.0-35	1000-1200	5000			10-100	
FRANCE													
surface	6.5-8.5	35	30	125		0.1	1.5				0.1		
sewer	5.5-8.5	600	800	2000	2	0.1	1.5				0.1		
NAMIBIA													
surface													
sewer													
WINDHOEK		1000		5000			5	250	1000		1		Nil

COUNTRY	pH	SS mg/1	BOD_5 mg/1	COD mg/1	S^{2-} mg/1	Cr^{6+} mg/1	Cr^{3+} mg/1	SO_4^{2-} mg/1	Cl^- mg/1	TDS mg/1	Phenols mg/1	NH_4^+ mg/1	O & G mg/1
EGYPT													
surface	6.0-9.0	30 (20)	20-30	30-40	1	0.05	1	N.I.	N.I.	800-1200	0.001-0.002	100	5
sewer	6.0-10	500	400	700	10		5.0-10.0	no limit	no limit	2000	0.005	100	100
SOUTH AFRICA													
surface	5.5-9.5	25	10	30	1	0.05	0.5				0.1	10	
sewer	5.5-12.0	400-2000	200-1400	2000-5000	5.0-50		10.0-50	300-1800	1000			20-30	50-400
KENYA													
surface	6.0-9.0	30	20				1						trace
sewer	6.0-9.0	300	450					100	3000			100	100
MOLDAVIA													
surface													
sewer													
(Kishinov)	6.5-8.5	500	474	1000	1	0.2	3	160	200	1000	0.1	8	30
SPAIN													
surface	5.5-9.5	80-300	40-300	160-500	1.0-2.0	0.2-0.5	2.0-4.0	2000	2000		0.5-1.0	15-50	20-40
sewer	8.0-10.0	500-750	750-1000	1500-2500	1.0-20	0.5	3.0-5.0	2000	2000		2	85	150
BRAZIL													
surface	6.0-9.0		60		1	0.5	2.5				0.1-0.5	5	20-30
sewer					5		5						100

Ref: Manual on Tannery Effluent Treatment, UNIDO Training Workshop, 11-16-October Gweru, Zimbabwe

Appendix

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