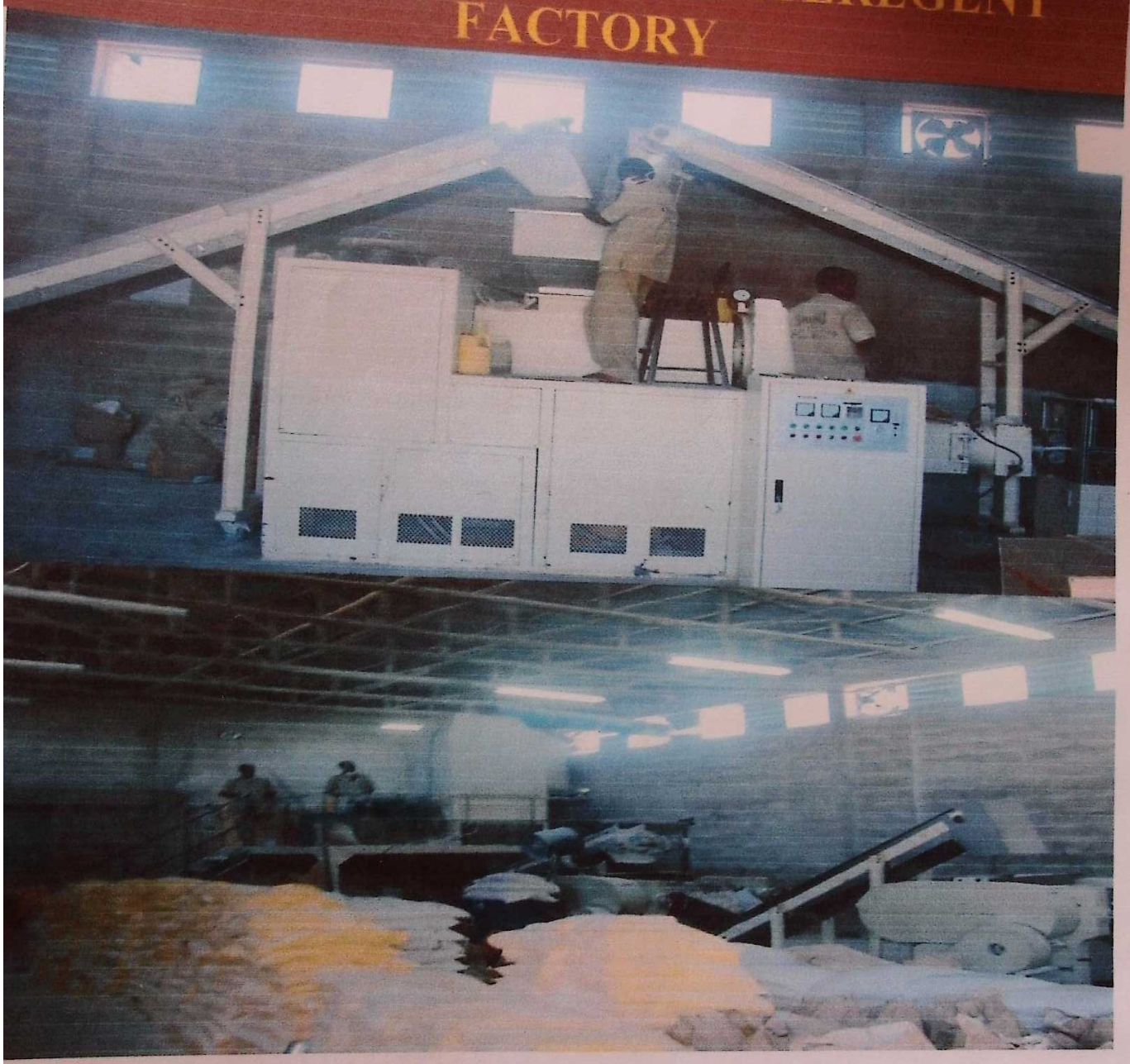
ENVIRONMENTAL IMPACT ASSESMENT OF SHEMU SOAP AND DETEREGENT FACTORY



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EXECUTIVE SUMMARY

Introduction

This report represents an environmental assessment of the '**Shemu Soap and Detergent factory Project'**, a private limited company established under Ethiopian law to produce soap, detergent for local and foreign markets. The proposed project is located in the Dire Dawa City Administration specifically at an area allocated for industrial development purpose which is located at about 8 km from Dire Dawa main asphalt road. The total area under the holding of the operating factory is 10,000 sq. m. and request for additional 10000m2 area has been filed to the City Manager Office.

This environmental impact assessment (EIA) study was conducted according to legal requirements of the EIA proclamation of the government of the Federal Democratic Republic of Ethiopia, proclamation No.299/2002. This report is also submitted to the Environmental Protection Authority of Dire Dawa State as per to the requirement of the proclamation.

The fundamental objective of the environmental assessment is to ensure that the proposed soap and detergent factory development project is environmentally sound and contributes to the development of environmental assets. It is also expected to provide a means whereby the overall environmental performance of this project can be enhanced.

The methodology used follows the conventional pattern for industrial development project EIA study and meets the requirements of EPA's Environmental Impact Assessment guideline. Data collection both from primary and secondary sources; identification and analysis of significant environmental issues on the basis of those data; choosing mitigation and enhancement measures; and developing environmental protection, monitoring and management plans are the methodological approaches followed in conducting the EIA study.

Environmental Scoping

An initial environmental examination and environmental scoping exercise has been carried out with the following main objectives:

- To define the limits of the study area
- To define list of Valued Ecosystem Components within the study area
- To define list of activities, type and magnitude of the proposed project
- To define list of Impacts to be studied

Project Description

The proponents proposed this project having an overall goal of taking advantage of the opportunities existing for the demand of cleaning agents and come out as a successful manufacturer Soap and Detergent earning economical earnings for self benefit and for the benefit of Ethiopia. In planning the project; establishing a factory that produces and provides Soap and Detergent to the market is the primary objective of the proponents, whereas the socio-economic benefits that can be generated from the project are the cumulative objectives of the proposed project.

The project has planned to produce laundry soap and toilet soap and liquid detergent products at a capacity of 3MT/hr, and 6tons/day respectively. The project time table indicates that the factory commissioning expected after 6 months starting from the start of preparing the feasibility study.

Policy, Legal and Institutional Framework

Laws, Policies and institutions were considered for the dual purposes of identifying potential project constraints, and establishing background for realistic, sensitive recommendations. With this respect policy, legislative and institutional issues that are most relevant to industrial projects in general and this soap and detergent factory projects in particular have been reviewed.

This review found the following three programs and trends to have a strong bearing upon the project: 1) National policies and strategies towards economic development and sectoral development; 2) environmental protection and conservation; and 3) governmental policies towards decentralization and local self-determination.

Baseline Environmental Condition of the Project Area

Environment means surroundings, which are comprised by things and conditions. Those pertaining to the Shemu Soap and Detergent Manufacturing Project have both bio-physical and socio-cultural aspects. The project site covers a total area of 20000 m^2 while out of this 10000m2 of land will be obtained from City administration at industrial zone.

Environmental Impacts and Proposed Mitigation Measures

The EIA discusses major environmental issues and constraints that can arise from the project implementation. Direct, indirect and cumulative impacts are addressed. These impacts are further divided according to their nature into negative or positive; random or predicted; temporary or permanent (reversible or irreversible) and short term or long term. The project is characterized by short term and insignificant pre-construction and construction stages impacts and long-term significant impact during operation stage.

The major positive impacts of the proposed project are mainly those of economic benefits at the national, regional and local level due to creation of employment as well as technology and capacity building for the citizens, while the major adverse impacts are mainly results due to the generation of environmental pollutant wastes from the production process and other utility service units. Among the adverse impacts nuisance odor, emission of particulate matter and wastewater effluents are the main concerns associated with the project.

Cost-effective and environmentally sustainable techniques that can mitigate the adverse impacts were proposed. Emphasis is given for best available techniques for prevention of air emissions and wastewater effluents and control of their environmental impact.

Special consideration is given to enhancement of positive effects of the project (e.g. utilization the local manpower at different stages of the project and hiring them during the production stage when there is the possibility to do so).

Analysis of Alternatives

The sustainability goal of the project can be addressed if and only if the project is environmentally, socially and economically viable. To achieve this; the Consultant considered different project alternatives and analyzed them from these three sustainability dimensions. The alternative analysis focused on those significant negative impacts of the project (i.e. nuisance odor, air emissions and wastewater effluents). As these environmental pollution problems are prominently related with the type of the main raw material input for soap production (i.e. oil and fat) to be used and the process technology; alternatives regarding the type of the main raw material input and alternative production process technologies were considered and evaluated. In addition to these project alternatives, no project alternative (i.e. the project area without the project future scenario) is also considered as one alternative and evaluated.

Environmental Management Plan

Environmental management is concerned with implementation of the measures necessary to minimize or offset adverse impacts and to enhance beneficial impacts. Unless the mitigation and benefit enhancement measures identified in the EIA are fully implemented, the prime function of EIA, which is to provide a basis for shaping the project so that overall environmental performance is enhanced, cannot be achieved.

In order to be effective, environmental management must be fully integrated with the overall project management effort at all levels, which itself should be aimed at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions efficiently throughout its life. Hence, the overall goal of the Environmental Management Plan (EMP) of Shemu Soap and Detergent Manufacturing Project is to minimize adverse impacts of the project by managing and implementing the

proposed impact alleviation measures and good working practices. The environmental management plan at the pre-production and production stages has different objectives.

A great concern is given for the environmental management and protection program during the soap and detergent production phase. The objectives of the environmental management program at this phase of the project are: protection of the environment from the production process and service and utility unit pollutants, protection of workers from work area health hazard, efficient use of water and energy resources, waste management and improve the environmental performance of the company.

Beside the environmental management tasks to be performed by different functional units of the company; the Consultant proposes an environmentalist and safety officer to operate the environmental management program at this stage of the project.

The environmentalist and safety officer will coordinate and monitor all aspects of the environmental management programs; develop further an environmental oversight capability within the company; and facilities for the implementation of companywide Environmental Management System (EMS).

Environmental Monitoring Program

Various kinds of environmental monitoring and evaluation will be conducted by responsible staffs of the company. The Environmental and Safety Officer will be responsible for most of the monitoring activities and will report to the company top management in a weekly basis. The company top management and affiliated units of the Dire Dawa Environmental Protection Authority , such as technical divisions of the industrial pollution prevention and control department will make occasional and random monitoring, respectively. The monitoring will involve both quantitative and qualitative data, as appropriate to the nature of the information which will involve during the production stage of the project.

Conclusions and Recommendations

The implementation of the proposed Soap and Detergent Manufacturing project will have a pack of economical and social benefits. It plays a role on the Country's economic

development activity; as the project creates an employment opportunities for citizens, generates income for the local community. On the other hand, the proposed project has some associated environmental aspects that might cause adverse impacts. However, most of these environmental effects can be reduced to acceptable levels with good engineering practices; implementation of pollution prevention and control techniques, and integration of restoration and other mitigation measures proposed in this EIA report. Therefore, it can be concluded that there will be no severe or immitigable impacts that will prevent the implementation of the proposed industrial development project. To have minimal and acceptable residual environmental impacts, it is recommended that the proposed mitigation measures should be properly implemented. A close follow up of the effectiveness of the implemented measures is recommended since a well-planned monitoring program is critically important.

CHAPTER 1: INTRODUCTION

1.1 General

Shemu Soap and Detergent Plc. is a private limited company established under Ethiopian law to produce Soap & Detergents for local and foreign markets. It is involved in the production of 3MT/hr Laundry soap, 6 ton / day of liquid detergent.. The total area under the holding of the factory is 10, 000 sq. m. Besides, it requires additional 10,000m2 land for the proposed expansion project.

This environmental impact assessment study which has been conducted according to legal requirements of the EIA proclamation of the government of the Federal Democratic Republic, proclamation No.299/2002. According to the requirement of the proclamation, this report is also submitted to Dire Dawa City Administration Environmental Protection office,

The purpose of the EIA study is to identify, and analyze the magnitude of significant environmental effects which are likely to arise from the various activities during pre-construction, construction and operation phase of the existing and expansion project of shemu Soap and Detergent Manufacturing firm and to recommend some mitigation mechanisms for induced adverse environmental impacts.

Various EIA tools for identification, prediction and analyses of impacts were used. Proper public consultations were also held and the outcome of the consultation is included in the report. Significant positive and negative project impacts have been identified. Environmentally sound impact mitigation and management options were also suggested.

The Environmental Assessment (EA) guideline (EPA, 1999) prepared by the Environmental Protection Authority (EPA) requires development projects reduce adverse effects on the physical, biological and socio-economic environment. Appendix 1 of the guideline lists schedule of activities that require full Environmental Impact Assessment (EIA), partial Environmental Impact Assessment or those that do not require EIA study. As industrial projects in general cause a wide range of direct and indirect impacts on physical, biological and socio-economic environment of mankind, the proposed project is among those investment projects that require

full EIA study. To this effect, shemu Soap and Detergent Manufacturing Plc; the proponent of the project, has assigned the consultant to undertake a detail Environmental Impact Assessment Study for shemu Soap and Detergent Manufacturing Project.

In response to the requirements of the EIA study, the consultant carried out this Environmental Impact Assessment for the project under consideration. This report represents the findings of the Environmental Impact Assessment (EIA) carried out as an integral part of this assignment.

1.2 Objectives of the Environmental Impact Assessment

The fundamental objective of the environmental assessment is to ensure that the proposed soap and detergent factory project is environmentally sound and contributes to the development of environmental assets. It is also expected to provide a means whereby the overall environmental performance of this project can be enhanced through:

- Identification of sensitive environmental components likely to be affected by the proposed industrial development project,
- Identification and evaluation of the potential impacts associated with project implementation and subsequent operation, and
- Preparation of plans and recommendations regarding measures that will minimize adverse impacts and enhance beneficial impacts.

1.3 Methodology

General

The methodology used in this assessment follows the conventional method for industrial project EIA study and meets the requirements of EPA's Environmental Impact Assessment Guideline. The methodology followed by the consultant for the study includes ,but not limited to: collection of necessary data and documents, reviewing of relevant studies, impact analysis, choosing mitigation and enhancement measures using different optimization tools, employees consultation and developing environmental protection, monitoring and management plans.

1.3 .1 Collection of Available Information

The consultant has collected and reviewed documents on national policies, legislatives, regulations and guidelines as well as international conventions and protocols ratified by the Federal Democratic Republic of Ethiopia. Besides, necessary information assessed from Central Statistical Authority (CSA) census reports and documents.

The consultant has conducted field assessment to carry out collection of information through observation and technical measurements. Parallel to this, proper data collection activities performed on the specified industry site using different tools and techniques, including the preparation of check lists appropriate for this project.

1.3.2 Field Visits

Two round site visits was made to assess the environmental conditions of the site for the proposed Project, influence areas and to identify sensitive environmental components that are likely to be significantly affected by the proposed project. During the field investigation, information on physical and biological resources, socio-economic as well as socio-cultural profile data has been collected.

1.3.3 Employees consultation

As it's known the location of the project area systematically located outside the residential area of the town, consultation conducted with the employees of the factory during impact study. During the impact study in addition to the employees of the factory, management members were interviewed using the pre designed check lists. . The consultation process involved the workers of the already established manufacturing setups located close to the project site and in the influence area.

Report Structure

Including the Introduction part, the main body of the EIA report is structured under 10 chapters. Chapter 2 discuses the environmental scoping process and presents the findings of the scoping exercise. This is followed by the description of the project, which is presented under Chapter 3. Chapter 4 reviews the policy, legal and institutional frameworks that are relevant to the project under consideration. The description of the existing environment is covered under Chapter 5.

This chapter deals with the physical, biological, socio-economic and cultural environment of the project area and provides a baseline data on the environmental settings of the project site.

Chapter 6 deals with the impact assessment and proposing measures for mitigating/ enhancing impacts. Under this chapter the potential positive and negative impacts as well as their enhancement or mitigation measures are presented. Chapter 7 of the report presents the analysis of project alternatives from the environmental impact perspectives. Chapter 8 discusses the Consultant's proposed Environmental Management Plan for the implementation of the mitigation measures. Chapter 9 is the monitoring plan for the proposed environmental management of the proposed project. In the last chapter; Chapter 10 of the report, the major conclusions and recommendations are highlighted under the conclusion and recommendation section.

CHAPTER 2: ENVIRONMENTAL ESCOPING

In the aim of deciding upon the limits of the study area for the project and drawing the list of activities and impacts to be studied during the assessment, the Consultant carried out an initial environmental examination and scoping.

The scoping exercise has been carried out with the following main objectives:

- To define the limits of the study area
- To define list of Valued Environmental Components
- To define list of activities, type and magnitude of the proposed project
- To define list of Impacts to be studied

In order to carry out the above tasks, the consulting team employed different tools and techniques relevant to the proposed project. Use of environmental scoping checklists and consultation of different stakeholders (including experts, project affected peoples, local administrators and other people, etc).

2.1 Limits of the Study Area

The proposed expansion site of the project will be adjacent to the existing firm. Therefore, the impact area is limited within 20,000 m2 land and surrounding areas adjacent to the project. It is obvious that .the project site is located within the industrial zone of the city, specifically demarcated for similar and related processing categories. Therefore, the focus of the study is limited within this area..

2.3 Valued Environmental Components within Study Area

The proposed project site is totally found in the industrial zone of the city administration. Therefore, there are no human settlements at the nearer distance of the project. The consultant has focus on biological and physical components found in the area. Besides, the employees and on site customers have been included as important elements of the study.

CHAPTER 3: POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

Similar to other industrial development projects; the proposed shemu Soap and Detergent Manufacturing Project is influenced by several policies and programs aimed at development and environmental protection. Therefore; policies, legislations and institutional frameworks most relevant to industrial projects in general and to the proposed project in particular were assessed, reviewed and presented.

3.1 Administrative and Institutional Framework

The following paragraphs discuss the institutional and administrative framework at the Federal and Regional level and organizations responsible for the preparation of environmental policy and technical guidelines.

3.1.1 National

The administrative structure of FDRE is based a Federal system that has nine regional states and two special city administrations Environmental protection activities are directed and managed at the national level through three levels of institutional arrangements. These are namely, the Environmental protection council, the Environmental protection Authority and inter-ministerial commission coordinating Mechanisms.

Environmental protection Council

The proclamation for the establishment of the Environmental Protection Authority establishes Environmental Protection Council to ensure the integration of environmental concerns with development policies, strategies and plans as well as coordination among sectors. The council is composed of the Ministry of Agriculture, Ministry of Trade, Ministry of Industry, Ministry of Health, Ministry of Mines and Energy, the commissioner of Science and technology, the Ministry of water resources and the general manager of EPA. An official to be designated by the government chairs the council.

Environmental Protection Authority

The Environmental protection Authority (EPA) is the competent Environmental Agency at the Federal level in Ethiopia established by proclamation No. 9/1995. Article 5 of the proclamation states the following as the objective of the EPA.

The objective of the Authority shall be to ensure that all matters pertaining to the country's social and Economic activities are carried out in a manner that will protect the welfare of human beings as sustainably protect, develop and utilize the resource bases on which they depend for survival.

Over the last few years, EPA has been working on streaming its organizational structures in such a way that it will enable it to conduct its duties and responsibilities effectively.

When it comes to EIA, the Federal Authority will only be involved in EIA processes where a proposed activist may:

- Have an Environmental effect across the international boundaries of Ethiopia;
- Have an Environmental effect across regional boundaries with in Ethiopia;
- Have an effect on an Environmental of national or International significance;
- Have a Federal Government Department, the relevant regional Authority or another statutory body as proponent.
- Have the Federal Investment Authority as the investment approval body.

Inter-ministerial Commissions and coordinating mechanisms

Besides the Environmental protection Authority and the Environmental protection council, there are a number of inter-ministerial commissions that are established in the form of standing national committees and boards facilitate cooperation and coordination different government ministries, authorities, commissions and NGO's and other relevant organizations. The following are some of these coordinating mechanisms that are of direct relevant to the sector.

- Chemical Weapons Convention Advisors board
- Ozone National Committee

- National Committee on Climate change
- National Radiation Protection Board.

3.1.2 Regional

Dire Dawa City Administration is one of the two city administrations and nine regional governments under the federal system of the Federal Democratic Republic of Ethiopia. Dire Dawa City Administration has a total area of about 1977 km^2.

There are 8 Bureaus and a City Manager Office that are directly a accountable to the office of the Mayor. Under these Bureaus and Manager Office there are about 41 offices that are accountable to their respective Bureau. Although, Environmental Protection Authority once was accountable to Finance and Economic Development Bureau, by considering its due roll and mandate it is made directly accountable to the Mayor Office. Dire Dawa City Administration Environmental Protection Authority that was established with the regulation No.147/2009. and Article 5.1 of the regulation mandates the office to 'formulate policies, strategies, programs, or guidelines pertinent to environmental protection and follow up its implementation up on approval while Article 5.12 mandates the office to 'regulate and follow up that any development activity is planned and implemented without damaging the environment and disordering its balance.

When it comes to EIA, the national provisions indicate the Federal EPA devolves responsibility to the regional environmental offices, especially for projects that fully under the jurisdiction of the regional governments.

3.1.3 Kebele Administrations

Dider Dawa City Administration is comprised of nine kebele administrations and 38 rural peasant associations. All nine Kekebele Administrations have their own Kebele Council elected by people of the kebele and serving for five years. Under every Kebele Council there is Executive Committee which is consisted of 7 cabinet members. According to Dire Dawa City Administration power devolution Kebele Administration is lower organ of power to administer the local people, to promote and implement local developments through out the kebele using its technical man power organized under different Desks. In addition to promoting and executing

local development agendas, the kebele Administrations are supposed to execute City Administration policies and facilitate their implementation and conducting tax and municipal fees collection .

3.1.4 Peasant Associations

Like Kebebe Administrations Peasant Associations which are established through out all 38 PAS in rural areas have their own council, which is democratically elected every 5 years. Every Peasant Association's executive committee has its own cabinet members of 8 to administer people who are residing in the boundary the association. The cabinet members of peasant association are composed of 5 members who are directly elected by the people of respective Peasant Association and the rest 3 members are directly assigned from Agricultural and Rural Development Bureau working as Development Agent, one from Health Bureau working as head of health post, and one from Education Bureau working as school master in the Peasant Association. The main responsibilities of the PA's include: promoting rural development, executing government policies and facilitate their implementation and conducting tax collection.

3.1.5 Community Based Organizations (CBOs)

Similar to the other rural parts of Ethiopia, community based organizations are present with the aim of providing services of one kind or another to the community. Among the notable once are the farmer's cooperatives, woman's association, youth associations and community edir associations. The farmer's cooperative is engaged in facilitating agricultural extension services such as plant/crop protection, provision of fertilizers and distribution of improved seeds. The woman and youth association works in close cooperation with the farmers' association they usually work with their respective members in improving their social and economic well-being as well as promoting relevant government policies. The community edir (burial Society) is one of the oldest traditional institutions which are unique to the country. The principal function of these associations is to organize funerals of its deceased members and usually they undertake all responsibilities from feeding the mourners to digging the graves and providing financial and moral support to the families to which death has taken place. And it also creates a loan service to the members in need.

Economic Development Policies and Strategies

3.2.1 The National Economic Development Strategy

The guiding strategy under the National Economic Development is known as the 'Agricultural Development led Industrialization' (ADLI) This strategy further developed in to sectorial strategies that include Agriculture, Industry, Mining, Population growth, technological progress, Economic and Social infrastructure, etc. The following can be identified as the core elements of the agro-industrial development strategy component of ADLI (MOPED 1993).

- The promotion of labor intensive technologies & utilization of domestic raw materials.
- Determination of the composition of industrial output based on the needs and income levels of the population.
- Government intervention to motivate the choice of labor intensive technology that makes extensive use of domestic raw materials.

ADLI has provided that basis for the development of the other national and sectorial policies and strategies that have direct relevance to the development of industry in the country.

3.2.2 Ethiopian Investment Strategy

There had been a number of investment proclamation and regulations issued by successive governments as the country started to move away from 'centralized economy' to 'mixed economy' (since 1992). These policy issues influence the project in different aspects.

Above all; the following two documents that constitute the building blocks of the current Ethiopian investment strategy, directly affect investment in the country in general.

- Proclamation No.37/1996: Investment proclamation of the FDRE
- Proclamation No.7/1996: Council of Ministers regulations to provide investment Incentives.

According to the Investment Proclamation No.37/1996, the objective of the investment policy of the federal Democratic Republic of Ethiopia(FDRE) are designed to improve the living standard of the peoples of Ethiopia through the realization of sustainable economic and social development. Article 13 of the proclamation specifies the required information for submitting an

application for investment permit. The first sub article under article 14, prescribes the procedure for issuance of investment permit, states the following:

> *Upon receiving an application for investment permit made in full compliance with the provisions of Article 13 of this proclamation, and after ascertaining within 10 days that the included investment activity would not be contravening the operational laws of the country and that, in particular, it complies with conditions stipulated in environmental protection laws, the appropriate investment organ shall issue an investment permit to the applicant.*

The Council of Ministers regulation No. 7/1996 provides the terms and conditions under which investment incentives are provided for investors. The investment incentive is divided into the following two categories: exemption from income tax and exemption from customs duty on imported machinery and equipment. The exemption from income tax is based on the following two criteria. The first criterion is the class of the investment as pioneer investment, promoted investment, or expansion and upgrading of existing investment. The second criterion is the location of the investment with respect to its potential contribution to equitable distribution of regional development.

In 1998, the government of FDRE issued the following proclamation and regulations with the objective of amending the investment proclamation and regulation issued in 1996.

- Regulation No. 116/1998: A proclamation to amend the investment proclamation
- Proclamation No. 35/1998: Council of Ministers Regulations on Investment Areas Reserved for Domestic Investors.
- Regulation No. 36/1998: Council of Ministers Regulations to Amend the Investment Incentives Regulations

3.3 Environmental Policies and Strategies

3.3.1 The Constitution

The constitution of the federal Republic of Ethiopia provides the overriding principles and legal for all legislative frame works in the country. The concept of sustainable development and the

environmental rights of the people are enshrined in the constitution by the following articles that stipulate the rights of peoples in Ethiopia.

Article 43: The Rights of Development

1. The Peoples of Ethiopia as a whole, and each Nation, Nationality and People in Ethiopia in particular have the right to improved living standards and to sustainable development.
2. Nationals have the right to participate in national development and, in particular, to be consulted with respect to policies and projects affecting their community.
3. All international agreements and relations concluded, established or conducted by the State shall protect and ensure Ethiopia's right to sustainable development.
4. The basic aim of development activities shall be to enhance the capacity of citizens for development and to meet their basis needs.

Article 44 - Environmental Rights

1. All persons have the right to live in a clean and healthy environment.
2. All persons who have been displaced or whose livelihoods have been adversely affected as a result of State programs have the right to commensurate monetary or alternative means of compensation, including relocation with adequate State assistance.

These constitutional provisions have served as the guiding principle of all activates that are related to policy formulation, strategy development and the formulation of legislative and institutional framework for environmental protection.

3.3.2 The Conservation Strategy of Ethiopia (CSE)

The CSE, approved by the Council of Ministers in 1996, provides a comprehensive and rational approach to environmental management in a very broad sense, covering national and regional strategies, sectorial and cross sectorial policies, action plans and programs as well as providing the basis for development of appropriate institutional and legal frameworks for the implementation (EPA/Ministry of Economic Development and Co-operation 1996, MEDAC). It also deals with providing a strategic framework for integrating environmental planning into a

new and existing policies and projects. It mainly recognizes the importance of incorporating environmental factors into development activities from the beginning so that planners may take into account environmental protection as an essential component of economic, social and cultural development.

3.3.3 The Environmental Policy of Ethiopia

The major policy framework document with respect to environmental management of Ethiopia is the Environmental Policy (EPE) of the FDRE approved by the Council of Ministers in April 1997. The Policy was prepared under the joint-effort of the Environmental Protection Authority (EPA) and the Environmental Planning Unit (EPU) of the then Ministry of Economic Development and cooperation (MEDaC).

The policy contains elements that imply the importance of main streaming socio-ecologic aspects in development programs. More specifically, there are two cross-sectorial policies components with a mainstreaming effect in the EPE. Article 4.6 of EPE covers different aspects of the importance of incorporating environmental costs and benefits in the development planning process. Under this Article, the initiation of a pilot project on the application of Environmental accounting in Ethiopia was identified as one of the policies directions. Furthermore, Article 4.6 states (EPA 1997, 21):

Article 4.9 of EPE covers the policy directive on E1A. The Article contains eleven sub-articles covering different aspects of EIA and the conditions under which EIA must be performed. Article 4.9.g (EPA 1997, 23) provides a provision:

> *To create a law on EIA process, this requires appropriate Environmental impact statements and environmental audits for private and state development projects.*

The sectorial policies of EPE contain policy directions that may ensure the promotion of sustainable industrial development in the country. More specifically, Article 3.8 of EPE provides policy directions for the control of hazards materials and pollution from industrial waste. This sectorial policy emphasizes the importance of pollution prevention and Minimization as the primary approach for pollution control. Article 3.6 states (EPA 1997, 15) :

To adhere to the precautionary principle of minimizing and where possible preventing discharge of substances and to disallow the discharge when they are likely to be hazardous.

Article 3.8.m, more specifically (EPA 1997, 16) states:

To promote Waste minimization processes including the efficient recycling of materials wherever possible.

3.3.4 Sectorial Policies and Strategies

National Health Policies and Strategies

Article 2 of General polices states the 'development of the preventive and promotive components of health care' as one of the basic polices component. The promotion of occupational health and safety (Article 2.2.2) and the development of Environmental Health (Article 2.2.3) are identified as priority policy areas for the health sector.

Article 5.2 states that the promotional and preventive activities shall address 'prevention of Environmental pollution with hazardous chemical wastes'. The Health sector strategy, which was developed in 1995, states the following in its article 1.3 (TGE 1995,..)

Agricultural schemes and industries will be expected to have strong health prevention and promotion program. Starting from inception, appropriate health advice has to be sought & incorporated in the project. Guidelines, standards, regulations & legislations will be prepared in order to assist the community, planners, builders, agricultural schemes and industries on safe disposal of waste, minimizing environmental pollution and incorporating appropriate health and safety standards in housing and work premises.

Ethiopian Water Resources Management Policy

The Federal Government of the Democratic Republic of Ethiopia issued a comprehensive & integrated water resources management policy in 1998. The policy document outlines the following as the general policy objectives (FDRE 1998:1)

- Development of the water resources of the country for Economic and social Benefits of the people on equitable & sustainable basis.

- Allocation and apportionment of water based on comprehensive and integrated plans and optimum allocation principles that incorporate efficiency of use, equity of access, and sustainability of the resources.
- Combating and regulating floods through sustainable mitigation, prevention, rehabilitation and other practical measures.
- Conserving, protecting and enhancing water resources and the overall aquatic environment on sustainable basis.

3.4 Legislative Instruments and EIA Guidelines

The Federal Government of Ethiopia is in the process of passing number of proclamations that are aimed at providing the legislative instruments for the implementation of the national environmental policy objectives and strategies. The following environmental protection proclamations were enacted by the council of Representative of FDRE.

3.4.1 Proclamation on Institutional Arrangements

This proclamation establishes the Environmental Protection Authority as an autonomous Federal Agency with the objective of formulating environmental policies, strategies, legislation, standards and directives. The proclamation also provides for the establishment of the Environmental Council to ensure integration of environmental concerns with development policies, strategies and plans, as well as coordination among sectors. The Environmental Council is chaired by the Prime Minister (or his designate) and is composed of ministers of the relevant line ministries, heads of other government agencies and representatives of trade associations and NGOs. The Executive Director of EPA will serve as member and Secretary of the Environmental Council. Furthermore, the proclamation requires every competent agency to establish or designate its own environmental unit, which shall ensure collaboration with EPA and be responsible to coordinate and follow-up that activities of the agency are taking place in harmony with this Proclamation and other environmental requirements.

3.4.2 Proclamation on Environmental Impact Assessment

The Federal Government has issued a Proclamation on Environmental Impact Assessment (Proclamation No. 299/2002) with a primary aim of making EIA mandatory for specified categories of activities undertaken either by the public or private sectors, and possibly, the extension of EIA to policies, plans and programs in addition to projects.

The provisions of the proclamation include:

- Projects will be subject to EIA and execution is subject to an environmental clearance from the EPA or Regional Government Environmental Agency, as applies
- EPA or the Regional Agency, depending on the magnitude of expected impacts, may waive the requirement of an EIA;
- All other licensing agencies shall, prior to issuing of a license, ensure that either EPA or the regional Environmental Agency has authorized implementation of project; and
- A licensing agency shall either suspend or cancel a license that has already been issued, in the case that EPA or the Regional environmental agency suspends or cancels the environmental authorization.
- Approval of an Environmental Impact Study Report (EISR) or the granting of authorization by the EPA or the REA does not exonerate the proponent from liability for damage.

The proclamation is based on the principle that each citizen has the right to have a healthy environment, as well as the obligation to protect the environment of the country. It contains provisions for Control of Pollution, Management of Municipal Waste, and Management of Hazardous Waste, Chemical and Radioactive Substance. It also encompasses provisions for the formulation of practicable Environmental Standards by the EPA, in consultation with competent agencies. Furthermore, it empowers the EPA or REA to assign Environmental Inspectors who have powers and duties to control pollution.

3.4.3 Proclamation on Pollution and Control

The environmental Pollution Control Proclamation (Proc. No. 300/2002) is promulgated with a view to eliminate or when not possible to mitigate pollution as an undesirable consequence of social and economic development activities. This proclamation contains general provisions on pollution control, environmental standards, powers and duties of environmental inspectors, rights to appeal and offences and penalties. The pollution control component includes provisions on management of hazardous wastes, chemicals and radioactive substances, management of municipal wastes and protection or the ozone layer.

3.4.4 Provisional Standards for Industrial Pollution Control in Ethiopia

The provisional standards for industrial pollution control prevent which is prepared by EPA in collaboration with UNIDO and issued in 2003 provides:

- Standards for Specified Industrial Sectors
- Standards for Industrial Effluents (General)
- Standards for Gaseous Emissions (General)
- Standards for Noise Limits.

PART 2 (i.e. Standards for Specified Industrial Sectors); of the document provides 'Emission Limit Values for Discharge to Water' and 'Emission Limit Values for Emission to Air' for 8 different industrial sectors. For those industries that are not stated under this part of the Standard (like the proposed Soap and Detergent Factory), PART 3 of the document provides a general standards for industrial effluents and gaseous emission. These general standards shall apply to all industrial effluents and emissions other than those from specific sectors under PART 2 of the document. Thus, issues stated under PART 3 of the document will be relevant to the proposed project.

The provisional standard prepared in the aim of identifying significant industrial pollution by indicating standards which must be observed and by indicating pollution limits beyond which the

environment would not tolerate. These standards will be periodically reviewed and updated in the light of additional information and knowledge.

3.4.5 EPA's Environmental Impact Assessment Guidelines (2002)

As part of the ongoing effort to develop environmental legislation and guidelines in Ethiopia, the EPA released its EIA guidelines document. The document provides a background to environmental impact assessment and environmental management in Ethiopia. The document aims as being a reference material to ensure effective environmental assessment and management practice in Ethiopia for all parties who are engaged in the process. The basic objective of the guide is:

- Providing all interested parties with a consistent approach in EIA
- Providing background information for the context of EIA in Ethiopia
- Assisting proponents in identifying their EIA responsibility
- Assisting communities & NGO groups in realizing environmental rights with regard to EIA
- Assisting the authority in determining their roles and responsibility as decision makers in the EIA process: and
- Assisting with regard to cost and benefits of proposed development projects.

The document details the required procedures for conducting an EIA in Ethiopia and the requirements for environmental management. These requirements are presented on a step-by-step basis in the guideline. In addition, the document specifies tools that may be considered when engaging in the EIA process. Reference is made to the legislation and policies with which potential investors and developers in Ethiopia must comply and key issues for environmental assessment in specific development sectors are detailed for consideration.

In addition, the EIA Guideline provides the categories, the relevant requirements for an EIA, and lists project types under each category. In accordance with this Guideline, projects are categorized into three schedules:

Schedule-I: Projects, which may have adverse and significant environmental impacts and therefore require a full Environmental Impact Assessment.

Schedule-2: Projects whose type, scale or its characteristics have potential to cause some significant environmental impacts but are not likely to warrant a full EIA study.

Schedule-3: Projects which would have no impact and do not require an EIA.

Accordingly, programs related to handling and processing fall into Schedule 1.

3.5 International Conventions and Protocols

In addition to national environmental legislations, there are also a number of regional and international conventions and protocols on environment. The government has established an Environmental Protection Authority, and this Authority is designated as focal point for the implementation of these conventions and protocols.

According to; Article 9(4) of the constitution of the Federal Democratic Republic of Ethiopia provides that once an international agreement is ratified through the accepted or established procedure, it automatically becomes an integral part of the law of the land. Consequentially, the convention and the Protocol are the laws of this land. Therefore; the following international conventions and protocols are relevant to the proposed soap and detergent manufacturing project.

3.5.1 Convention on Biological Diversity

The convention on biological diversity has three goals. These are:

- Conservation of biodiversity;
- Sustainable use of the components of biodiversity; and
- Fair and equitable sharing of the benefits arising from the use of genetic resources.

The convention was ratified by Ethiopia through proclamation No.98/94, May 31, 1994.

3.5.2 Framework Convention on Climate Change

Ethiopia ratified this convention through proclamation No. 97/1994 on May 2/1994. This convention takes into account the fact that climate change has trans-boundary impacts.

The basic objective of this convention is to provide for agreed limits on the release of greenhouse gases into the atmosphere so as to prevent the occurrence of climate change.

3.5.3 The Vienna Convention on the Protection of the Ozone Layer

The basic objective of the convention is to combat the negative impact on the environment and human beings resulting from ozone depleting substances by reducing the amounts released and eventually banning their commercial use through internationally agreed measures. The Montreal protocol entered into force in 1989 to facilitate the implementation of this convention.

Ethiopia ratified and become party to the Vienna convention and the Montreal protocol in January 1996. The National Meteorological services agency has been mandated for the coordination and supervision of implementation of this convention.

3.5.4 The United Nations Conventions to Combat Desertification

The objective of the convention is to combat desertification and mitigate the effects of droughts in countries experiencing serious drought and desertification, particularly in Africa. Ethiopia has ratified the convention through its proclamation no. 80/1997.

3.5.5 The Basel Convention

The objective of the Basel convention is to control and regulate the trans boundary movement of hazardous wastes. The Bamako convention of 1991 plays a similar role at the level of the African continent. Ethiopia ratified the Basel convention through its proclamation No. 357/2002. Its amendment was ratified through proclamation No. 356/2002. The country has also ratified the Bamako convention through proclamation No. 355/2002.

3.5.6 The Stockholm Convention

In 2002, Ethiopia fully accepted and ratified the Stockholm convention on persistent organic pollutants by proclamation No. 279/2002 designed to ban the use of persistent organic pollutants. The Environmental protection authority has the mandate to implement the convention at the national level.

3.5.7 Convention on international trade in endangered species of Fauna and Flora

The objectives of the convention are to control international trade in endangered species and to ensure that international trade in non-endangered species is carried out in a manner which ensures stable markets and economic benefits for the exporting countries as well as to control and regulate illegal trade in such non endangered species, fossils and/ or their derivatives. Ethiopia ratified the convention through proclamation No.14/1970. The mandate to implement the convention at federal level is the responsibility of the Ethiopian wildlife protection and development organization.

CHAPTER 4: PROJECT DESCRIPTION

4.1 Background to the Project

4.11 Project Goal

The project promoter has the overall goals of taking advantage of existing opportunities of market demand at local and national level for cleaning agents and to be a successful manufacturer of soap and detergent to earn financial advantages for self benefit and national benefits at large. Although the primary objective of the project proponent is to produce soaps of different size and detergents of different forms for marketing purpose so as to generate reasonable profit, realization of the project will have parallel socio-economic benefits which to be discussed in subsequent parts of the study.

4.1.2 Description of the Proposed Project

The proposed project comprises stock of different components to be executed at different phases of the project life. Breaking them down according to the type of activities will ease the identification of their likely environmental impacts at each phase of the project. Thus it is worthwhile to break down each activity of the project in to the following phases: pre-construction, construction, and operation and diligently investigating each activity separately to establish its impact on the environment.

4.1.3 Pre-construction Phase

This phase of the project comprises the following two main activities: Theses are:-

- Feasibility Study
- Environmental Impact Assessment Study

During the operation of the above two main activities there is no negative environmental impact on the project site as the studies are demanding only field visit and dusk work.

4.1.4 Construction Phase

- Civil Works
- Installation of utilities

- Erection of Machineries

The construction phase is composed of package activities as listed above. During the construction phase preparation of construction site which is adjacent to the Shumu Soap and Detergent factory one of main primary activities of construction. There will be excavation work that will cause disturbance on the soil profile, damage of soil particle, some biological organisms in the soil and vegetation on the project site. Nevertheless, these damages are temporary and will not have wide range of negative impacts on the surrounding environment.

4.1.5 Operation Phase (Production of Soap and Detergent)

The proposed factory will have two production process plants: Soap and Detergent Production Plants. From environmental point of view, this phase of the project is important. Thus, due consideration is given for this phase of the project and the activities and environmental aspects of each of the production plant is detailed in the following sections.

4.2 Description Soap Production Plant

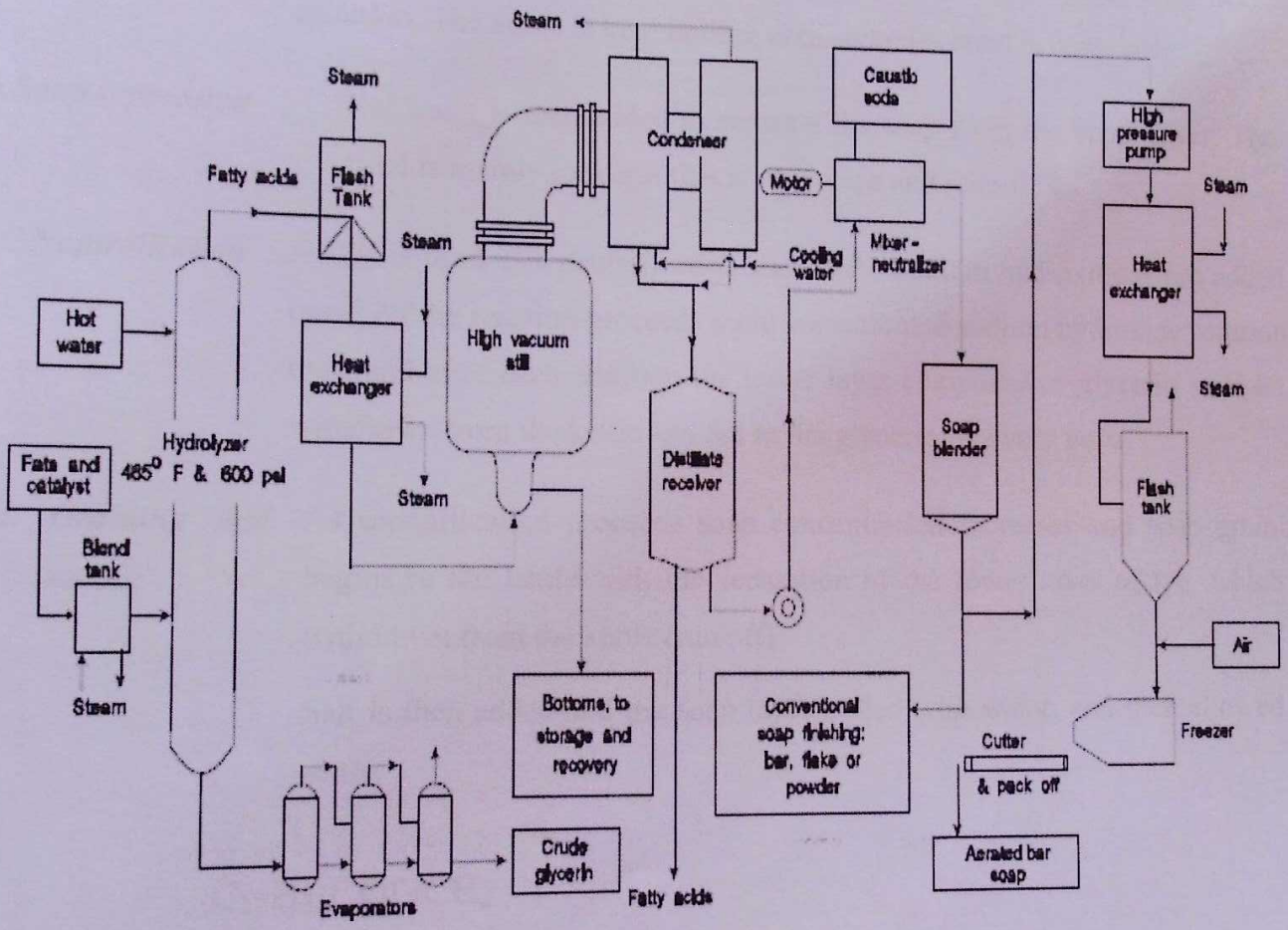
The process of production of soap and detergent begin with the process of producing hot water steam by reusing and burning used motor oil as source of energy and other materials as source of energy to boil up continuously supplied tape water to continuous supply water steam. The steam produced at this stage directly supplied to the soap processing plant that to melt the intermediate fat matter in to intermediate oil blend and mixed with caustic soda. At this stage the steam boiler releases some water steam in to the environment when the water in the boiler is over heated and excessive steam produced. In addition to this, excess condensed water also released collected in the septic tank.

The soap production plant produces two types of products: Laundry and Toilet Bar Soap. Generally, the production process comprises the following steps:-

1. Production of suitable soap base,
2. Mixing and homogenization of the soap base with additives, such as perfume oils, coloring matter, and skin-grooming substances(refuting agents),
3. Extrusion to rough form,

4. Shaping, and
5. Packaging.

Fig. 4.1(Below) indicates the production process of soap.



The production of suitable soap base is the main stage of the production process and aimed in the production of an ordinary fully boiled or settled soap. The processes take place in a steel kettle with slightly conical bottom. In the operations, the following is the process steps:

a. Saponification A solution of caustic soda (15%) is run and the melted fat and grease or oils are then pumped in. The amount of caustic soda is just enough to combine with all the fatty acids liberated.

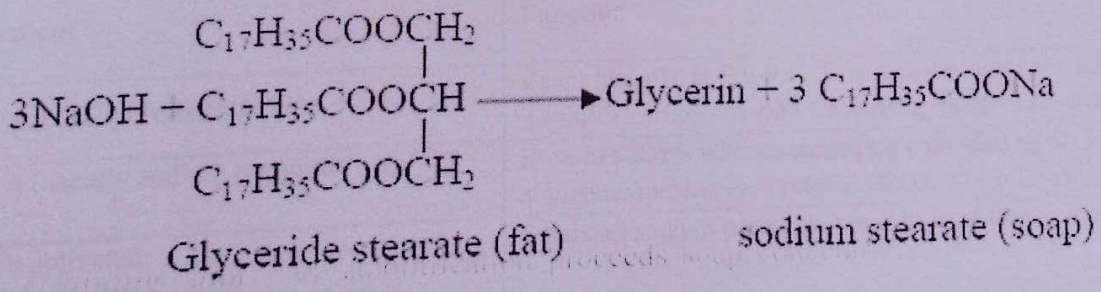
A direct steam jet entering at the base of the kettle provides both heat and agitation. The kettle is kept boiling until saponification is complete.

b.Soap separation NaCl salt is then added to separate the soap from the upper layer. The salt used is mainly rock slat that is recovered and reused.

C.Neutralization NaOH is used as a neutralization chemical. Sodium hydroxide is not added at once. As the reaction proceeds more concentrated sodium hydroxide solution is used and after each addition the lower layer composed of glycerin and slat is withdrawn from the kettle and fed to the glycerin recovery unit.

d. Graining and settling As saponification proceeds soap concentration increases and soap graining begins in the kettle with the separation of the lower layer of lye, which is withdrawn from the kettle (run off).

Salt is then added and the soap layer boiled with water, and then allowed to settle.



According to the feasibility study, the production capacity of the soap plant is 3MT/hr Laundry Soap.

4.3 Detergent Manufacturing Plant

Detergents use a synthetic surfactant in place of the metal fatty acid salts used in soaps. They are made both in powder and liquid form, and sold as laundry powders, hard surface cleansers, dish washing liquids, fabric conditioners etc. Most detergents have soap in their mixture of ingredients, but it usually functions more as a foam depressant than as a surfactant.

43.1 Liquid Detergent manufacturing

Step 1 - Soap premix manufacture

Liquid detergent contains soap as well as synthetic surfactants. This is usually made first as a premix, then other ingredients are blended into it. This step simply consists of neutralizing fatty acids (rather than fats themselves) with either caustic soda (NaOH) or potassium hydroxide

Step 2 - Ingredient mixing

All ingredients except enzymes are added and mixed at high temperature. The ingredients used in liquid detergent manufacture are typically sodium tripolyphosphate, caustic soda, sulphonic acid, perfume and water. The functions of these ingredients has been covered above.

Step 3 - Enzyme addition

The mixture is cooled and milled, and the enzymes added in powder form

Table 1: Typical post dosing ingredients

Ingredient	Function
Soda ash (anhydrous Na2CO3	Keeps the pH at 9.0-9.5. This ensures optimum detergent function. Also forms insoluble carbonates with Ca andMg, so acts as a water softener
Bleach (usually sodium perborate . NaBO3	Bleaches stains without damaging color-fast dyes. Sodium perborate breaks down at high temperatures to release H2O2, which functions this way.
Bleach activator (e.g. tetraacetylethylenediamine)	Catalyses sodium perborate breakdown at low temperatures
Enzymes (e.g. alkaline protease	Alkaline protease breaks down proteins in the alkaline conditions created by soda ash, helping to remove stains
Color and perfume	Create a more aesthetically pleasing product.

Figure 4.2 illustrates the various operations.

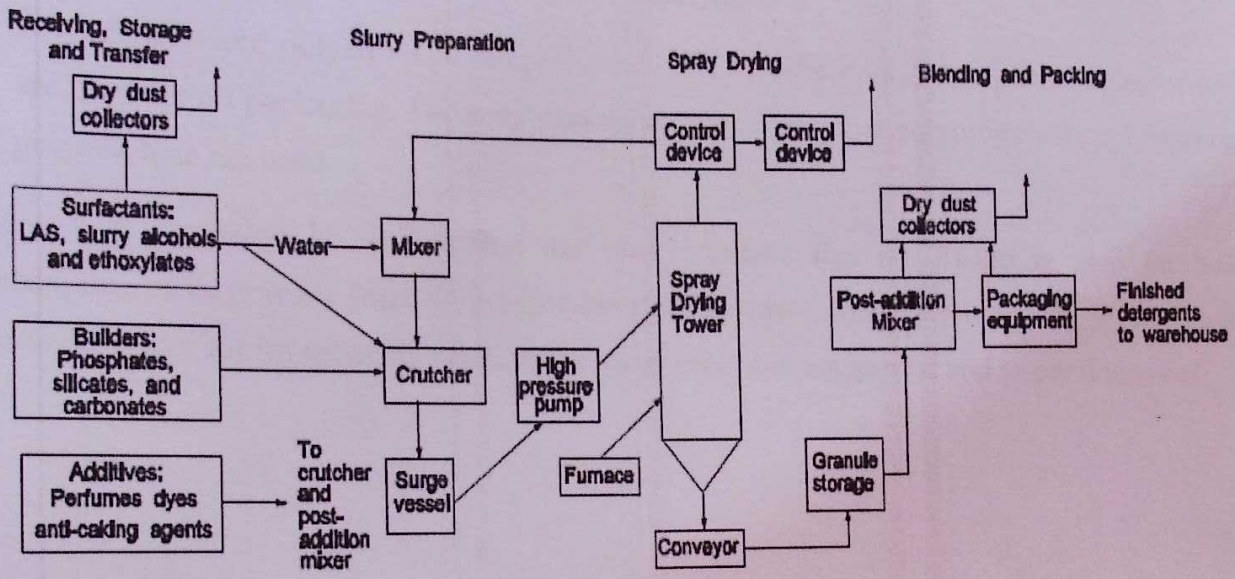


Fig. 4.2 Manufacture of Spay liquid detergent

4.4 Raw Materials and Utilities

Knowing the type of raw materials, chemicals used as well as products, allows the prediction of pollution hazards and expected pollutants. Generally, the main raw materials used in soap industry are seeds, such as cottonseeds, soybean, sunflower, or fruits as olives and palm. Also palm stearin, palm oil, animal fats, calcium silicate are used for soap production. The proposed project uses palm stearin as main raw material. However, in case of Shmu Soap and Detergent factory, the factory is using fat matter of olive oil that is imported and used as intermediate input to produce soap and liquid soap. In addition to this, the planned expansion of the project will use olive oil cake to produce soap and liquid detergent.

The chemicals used are caustic soda (NaOH), sodium silicate, sodium palmitate, tinopal, palm fatty acid, salt, sulfuric acid, hexane, fuller earth (bleaching agent), perfumes, coloring materials, coagulating agent (alum), soda ash, silica sand anti-oxidant and phosphoric acid, and sodium chloride, furnace oil.

In liquid detergents manufacturing the following chemicals are used by the factory: leaner alkali benzene sulphonic acid, STPP, sodium carboxyl methyl celelions, perfume foam booster, optical brightener, caustic soda and alcohol ethoxylate.

Polyethylene and polyethylene terephthalate (PET) plastic containers, glass bottles or cartoon are used for oil packaging. For soap packaging, sheets of paper polypropylene, polystyrene and polyethylene are used.

Steam is generated by boilers that use heavy furnace fuel oil. Steam is used for heating, stripping, or as primary fluid for jet-ejectors that provide vacuum requirements. Water is used as process water for fat splitting, wash water for product and equipment and as cooling water.

Table2: **Describes the main raw material and utilities to be used by the factory together their annual consumption.**

Main Raw Materials		
No	**Description (Item)**	**Annual Consumption (Ton) at Full Capacity**
1	Sulphonic acid	828
2	Caustic soda	1022
3	Sodium tri polyphosphate (STPP)	1,000
4	Soda Ash	1,100
6	Sodium Silicate	132.5
7	Sodium palmitat(brown)	5839.72
8	Sodium palmitat(white)	3221.9
9	Fillers(calcium carbonate,)	2814.64
10	Soda ash	417
11	Silica sand	923
12	Builder(Sodium, Silicate)	1252.02
13	Palm fatty acid	2919.86
Utilities		
No	**Description (Item)**	**Annual Consumption**
1	Furnace Fuel	41.5 ton
2	Water	2168metric ton
3	Electricity	280 KWVA
4	Steam	2000 kg/hr

The production process of the project discharges different types of pollutants to the environment. Fig. 4.3 & 4.4 illustrates the pollution sources of the three product categories.

Fig. 4.3: Soap Production Process and Pollutant Sources

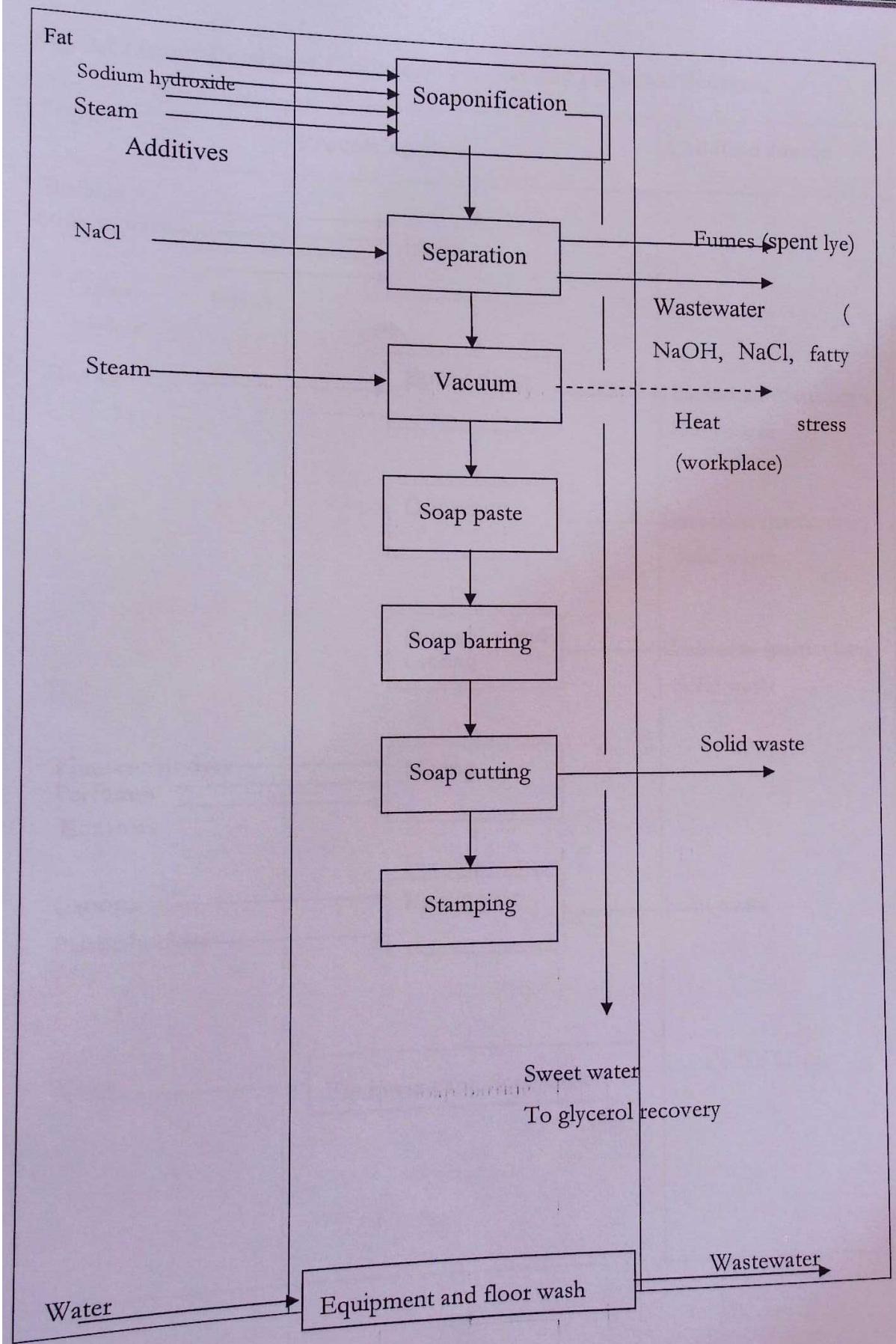
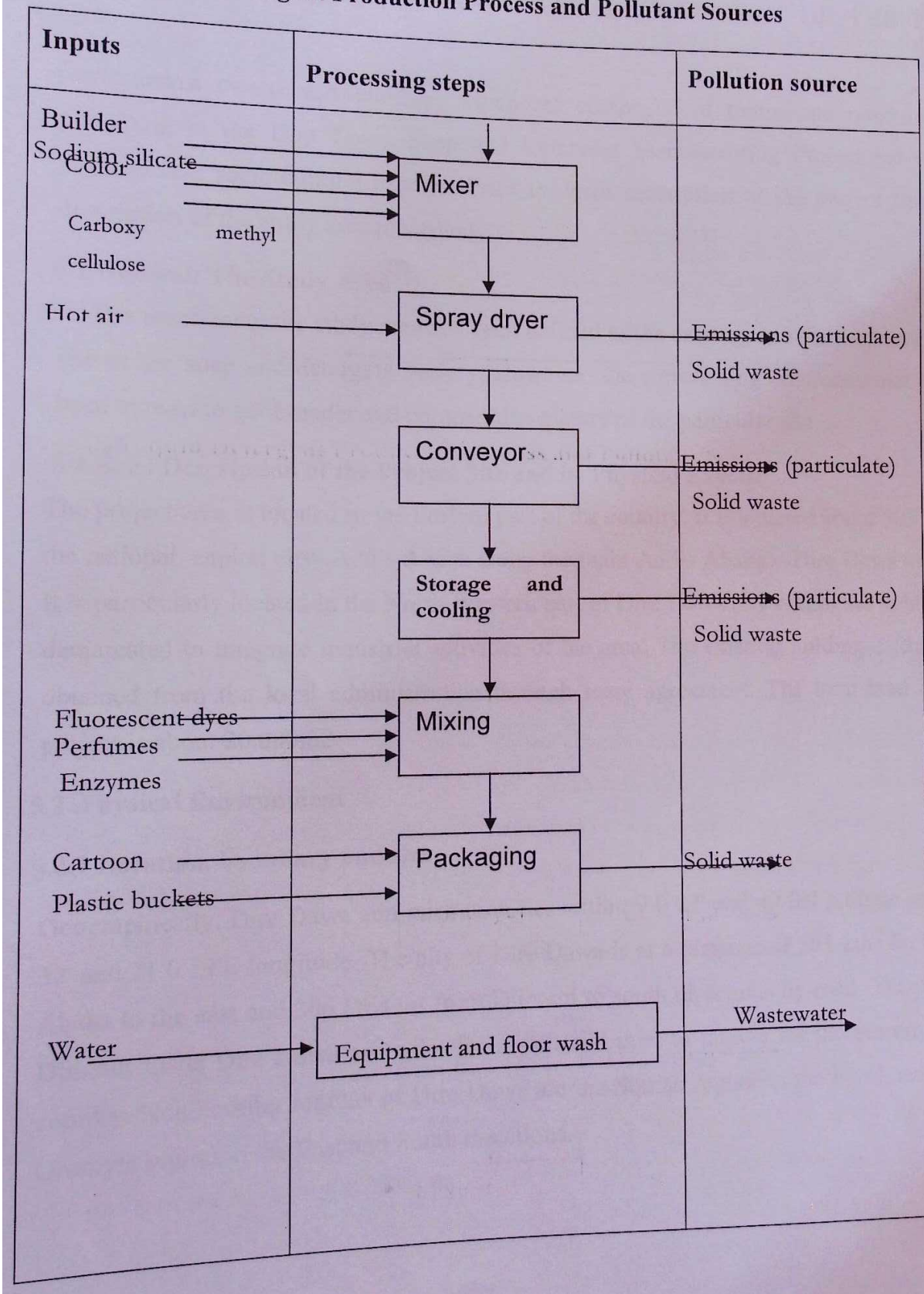

Fat
Sodium hydroxide
Steam
Additives
Soaponification
NaCl
Separation
Fumes (spent lye)
Wastewater
NaOH, NaCl, fatty
Steam
Vacuum
Heat stress
(workplace)
Soap paste
Soap barring
Soap cutting
Solid waste
Stamping
Sweet water
To glycerol recovery
Wastewater
Water
Equipment and floor wash

Fig. 4.4 Liquid Detergent Production Process and Pollutant Sources



CHAPTER 5: BASELINE ENVIRONMENTAL CONDITION OF THE PROJECT AREA

Environment means surroundings, which are comprised of things and conditions. Those pertaining to the Dire Dawa Soap and Detergent Manufacturing Project have both bio-physical and socio-cultural aspects. Prior to detail description of the project site a general description of the study area presented.

5.1 General: The Study Area

In this assessment the study area has been defined as the existing and the proposed expansion site of the soap and detergent factory. However, the surrounding environmental feature has been viewed to get broader and comparative picture of the particular site.

5.2 Brief Description of the Project Site and its Physical Layout

The project area is located in the Eastern part of the country. It is situated about 505 km East of the national capital city- Addis Ababa along the main Addis Ababa – Dire Dawa asphalt road. It is particularly located in the North Western part of Dire Dawa city within the industrial zone-demarcated to integrate industrial activities of the area. The existing holding of the project is obtained from the local administration through lease agreement. The total land area of the project is about 20,000m2.

5.3 .Physical Environment

5.3.1 Location, boundary and size

Geographically, Dire Dawa administration lies within 9 0 27' and 49 0N latitude and and 41 0 38' and 21 0 19'E longitude. The city of Dire Dawa is at a distance of 501 kms far from Addis Ababa to the east and 306 kms far from Djibouti to south directions by road. The proximity to Djibouti made Dire Dawa an outlet for export and inlet to import for the eastern part of the country. Neighboring regions of Dire Dawa are the Somali region in the North and West, and Oromyia region in the East and South directions.

The entire boundary area of the administration encompasses about 1977 km2. The spatial area of the city is about 187 Km2 which makes Dire Dawa the second largest urban center in the country following Addis Ababa.

5.3.2 Land escape and land feature

Dire Dawa is situated just at the foots of the hills stretching from south-east to west direction by making a boarder line between the highlands of the previous Hararghe region and the vast lowlands extending up to the red sea. The distance that the city has from the highland areas is very close, which provided a livable environment that served as one major factor for its establishment by the then Franco-Ethiopian and now the Ethio-Djibouti railway line.

The most northern and western parts of the administration is flat land and the rest areas are naturally ragged terrain land in topography. The landscape of the south- eastern and southern parts of the administration is dominated by sharp edged hills (escarpments) with a slope exceeding 45 %. The slope is gentle in other parts of the administration that goes down to 0 % in the flat areas.

Dire Dawa town is situated in the Awash River Basin, a basement depression being their sub-drainage. It is located in the eastern lowlands of Ethiopia within latitude 90 34' to 9o 35'N and longitude 410 50' to 410 52'E with an elevation ranging from 1130-1335 meters above sea level and mean elevation of 1160m amsl. Hills and steep slopes are found in the South, moderate and gentle slopes span to the north. Generally the city lies within the semi-circular ridge of hills to the east, south, and west which provide surprising natural vitas and delightful views from the center.

5.3.3 Climate

The climatic situation of the Administrative council is categorized mainly by warm and dry climate with relatively low rainfall and hence categorized as kolla climatic zone. Days are very hot and the nights are moderate in temperature. The climate is semi-desert during day and moderate at night. The vegetation around the town is predominantly Acacia-Savanna. The land immediately surrounding the town is covered with desert cactus. The mean annual precipitation

and the mean annual temperature are about 594mm and 25°c, respectively. As per the hydro-metrological data, Dire Dawa is one of the regions in the country with potential evaporation exceeding rainfall throughout the year and two rainfall patterns and characteristics. The short rain season is from March–April and the long rain season extends from August to mid-September.

Table3: Mean monthly climatic values of Dire Dawa town

atic ble	Jan.	Feb.	Mar	Apr	May	June	July	Aug.	Sep	Oct	Nov	Dec	Yearly mean
.	28.2	29.9	30.2	31.7	33.6	34.8	33.3	32.6	31.4	32.0	30.2	28.6	31.5°c
.	15.3	16.6	19.2	20.5	21.6	22.6	21.1	20.6	20.9	18.9	15.9	15	19.0°c
ity	39.3	42.5	44.4	47.5	35.2	30.0	41.4	40.8	34.6	27.6	29.6	29.9	41.4%
hine	8.8	8.0	7.8	7.4	8.4	8.1	7.5	8.0	7.7	8.3	9.4	9.3	
rati n)	217.6	199.8	283	245.7	283	323	293.8	283	266.8	283	242.2	221.3	(open water portion)
)	4.2	3.8	4.4	4.6	4.1	5.5	5.6	5.1	4.2	4.2	4.2	3.6	4.5m/sec
ll	20.7	21.6	84.5	68.3	45.3	20.6	91.8	146.0	85.3	32.2	12.9	11.1	640.3

Source: Dire Dawa Water Supply Project 2003E.c Report

5.3.4 Geology and Soils

☞ Gene ral geology

The geology of Dire Dawa composed of all major three-rock types (metamorphic, sedimentary and igneous). The IDP report of the administration depicts that the geological setting of the area consists of:

a) High grade basement rocks,

b) Mesozoic sedimentary sequences,

c) Quaternary volcanic, and

d) Quaternary Sediments.

Soil Types

Pertaining to the soil type of the area Fluvisols and others are generally dominant soil types of the area. The soil types of the Administrative Council vary according to the topography of the land forms, altitude and slopes.

5.3.5 Ambient Noise

The processing machine of the project has no significant noise both to the employees and the adjacent firms. Some mild track noise observed while the firm carries out transportation of products and inletting of raw materials to the site.

5.3.6 Water Resources

Surface Water

The proposed project is located within the Awash River basin. The basin the most used and studied basin so far in Ethiopia.

There is no perennial river or stream in the surroundings of Dire Dawa town. Several wads or rivers viz. Dechatu, Butiji, Goro, Melka Jebdu and Leghare are dissecting the city. One of the largest rivers crossing the city, Dechatu River, stretches along south north direction passing through the central parts of the built-up areas. These descend from the steep rift fault escarpment

and pass through the town. The wads are dry except during the rainy time, and they discharge big volume of flood when there is high rain fall on the escarpment and adjacent plateaus. The flood seizes to flow in few hours time after the rain stopped.

Legehare spring, which is located at UTM 1061625 N and 818219 E along Legehare dry river bed as per the ground water investigation of this report, is the only significant perennial surface water in the vicinity of the town. The study also stated that it is difficult to measure its exact discharge and it varies seasonally. The discharge of developed spring flow is estimated in the order of 30 l/s in dry months. The spring that is capped 100 years ago and piped to be used for the town's water supply system is currently contributing at 30 l/s rate of the town's water supply.

Several investigations were conducted in the ground water basin of Dire Dawa, and all concluded that there is no feasible surface water resource to be developed as water source, with exception of Legedol/Lege Hare spring.

Ground Water Resource

Ground water is water contained in beds of rock, gravel, and sand, termed "aquifers," beneath the land surface. The principal source of ground water is rainfall, and aquifers are replenished, or recharged, by seepage of rainfall into the ground. An aquifer's recharge area may be close to or distant from a well location. Geology controls the abundance of ground water. In general, wells drilled into dense rocks, such as granite; do not yield large quantities of ground water. On the other hand, wells that penetrate unconsolidated formations of loose sand and gravel will often yield large quantities of water.

Previous studies and drilling at different parts of Dire Dawa Administrative Council (AE, 1990 for Dire Dawa town water supply at Sabian, WWDE, 2000 at Haseliso for Harar town Water supply, etc) indicates that the down throw block of the western part of the Dire Dawa area to have high groundwater potential.

All the previous studies and the ground water investigation under this study concluded that Dire Dawa has huge potential of ground water that could safely and economically be utilized for drinking water source.

The water abstraction report of the feasibility study stated that previous studies and drilling at different parts of Dire Dawa Council territory (AE, 1990 for Dire Dawa town water supply at Sabiyan, WWDE, 2000 at Haseliso for Harar town Water supply, etc); indicates that the down throw block of the western part of the Dire Dawa area to have high groundwater potential.

The existing water source of the town is also mainly from Sabian wells and few other boreholes drilled in different corner of the town, in addition of to the Legedol Spring discussed earlier.

5.3.7 Biological Environment/Flora and Fauna Resources/ Land cover and Vegetation

According to the existing land use map of the administration, bush lands, scrub lands and shrub lands cover 38.2 % of the total area of the council. The cultivated land with shrubs and grasses account about 18.7 % of the total area of the region. The largest portion of the region is bare land, where rock out crops and bare land are the main components and account for about 36.1 % of the total area of the Council.

The natural terrestrial vegetation in the project area has been significantly modified by human pressure. Bush and shrub of different species scattered within and around the area..

Flora

Acacia woodlands, bushes, open shrub lands and grass lands are typical features of the region's vegetation cover. Patches of junipers trees are also seen in the upper mountain ranges. Plantation trees and tree hedges within the city proper are significant and are providing shades and aesthetic values to the area. List of some of the plant species of the area are included under the annex section.

Fauna

As there is no forest cover that suit for wild life habitat, one cannot expect much wild life species in the DDAC. But, there are still some wild lives that have managed to survive in such disturbed environment. Some of these wildlife include; Hyena, baboon, Warthog, Leopard, Common fox, Gazelle, Dikdik, Porcupine, Zebra and Lion. List of some of wild life species found in the administrative council are included under the annex section.

5.3.8 Avifauna

According to the Master plan study of 2002, the following are some of the bird species found in the project area: Tropical Bouboou (Laniarius ferrugineus), Vultrine guineafowl (Acryllium vulturinum), Coqui francoline (Francolineus coqui), Lilac-breasted roller (Coracias abyssinica), Ring-necked dove (Streptopeliaca picola), Black headed oriole (Oriolus larvatus), Blue-eared glossy starling (Lamprotornis chalybeaus), Paradise flay catcher (Terpsiphone viridis), Yellow-billed ox pecker (Buphagus africanus), Black-headed weaver (Ploceus cucullatus), African citril (Serinus citrinelloides) and Yellow-billed hornbill (Tockus flavirostris).

5.4 Socio-Economic Environment

5.4.4 Population and Settlement Pattern

Dire Dawa is the second largest city in its population size in the country next from Addis Ababa. According to the projected population size by CSA, the city has a total population of 250,000 at present. The population in the surrounding rural parts of the administration is estimated to be 100,000.

Of the entire population of the administration, 49.7 % are female and 50.3 % are male in sex. The corresponding percentage share of the female and male population of the city is about and % consecutively. The annual growth rate of the population in the city exceeds 4.1 %. In migration is significant in its contribution to the population growth of the city, which according to CSA accounts about 60 % share in the average annual growth rate of the city's population.

In 1950's and 60's, the flow of migrants to the city was attributed to the increasing demand for industrial labor. The rate of migration of people to the city was also moderate and absorbable by the economy and within the carrying capacity of the available urban infrastructural facilities and services. However, the trend has totally been changed to a distressful situation starting from mid 70's up to the late 80's. The migration rate to the city during this period has grown in a multifold manner and recorded to exceed 7 % per annum. The pull factor for migration was totally contraband activities that overwhelmingly had controlled the entire business activities carried out in the city.

Recently, the city has exhibited faster population growth both through natural increase and migration. On the basis the growth rates and sex distribution ratios of the 2007 National Census, the population of Dire Dawa town has been projected to the current year and is shown on table 1.2 below. The projection is based on CSA 2007 base population and recommended medium variant rate by CSA.

Table 4: Projected Population

Kebele No.	2007 CSA Population	Projected Population at 2010
1	11200	12857
2	30970	35553
3	22563	25902
4	25963	29805
5	26243	30126
6	25241	28977
7	30527	35045
8	33787	38787
9	26359	30260
Total	**232,854**	**267,311**

Source: Dire Dawa Finance and Economic Development Bureau Statistical Abstract 2002

Regarding the settlement pattern there is high concentration in the inner city. However, recently there is high influx of people in different expansion directions including Sabina where the expansion project is located adjacent. There is no well established residential area around the project side, as it is located within the relative center of the industrial zone of the city.

Regarding the social characteristic of the city, Dire Dawa serves as resident place for many national groups having different origins of residence across the country. According to CSA population census report in 1994, the population of the city is a mixture of numerous ethnic

Groups. Of these groups, the Amara, Oromo, Southern nations and nationalities and Somali constitute the larger composition in their population size.

Despite deferring in cultural set-ups, the people of the city are well-known of peaceful coexistence. Keeping all its identity (customs, traditions, culture, and multi-lingual assets) assimilation in the sense that understanding and respecting other's compatriots identities are the mysterious source for the development of collaborative/cooperative culture with social intimacy and mutual assistance among themselves.

5.4.2 Economic structure and livelihood

Dire Dawa's strategic geographic location between Addis Ababa and the port of Djibouti has accorded it various economic and commercial advantages. It serves as transit and terminal for import and export of commodities and services. Import export trade thus characterizes the town's economic structure.

Micro and small scale enterprises are important in forming the livelihood of more than 55 % of the population in the city. MSEs Development is part of government poverty and unemployment reduction strategy in urban centers. Hence, government sector and NGOs commenced financial, technical, institutional and infrastructural supports to MSEs operators reflected maintained in the five years plan of the administration.

5.4.3 Social services

There are 75 schools, 11 colleges (private and government) and one University as far education sector is concerned. According to Education Bureau of the administration, Primary school enrollment is almost 100% at present in both sexes. There are four health centers, one public and three private hospitals, several private clinics and many drug shops in the city.

5.4.4 Energy Sources and Coverage

According to the IDP report of Dire Dawa Administration (2006) the total energy consumption of the administration during 2002 was about 2924 tera joules (TJ) of which 58 percent comes from biomass fuels (50 percent woody biomass, 4 percent charcoal and 4

percent agricultural residue), 37 percent from petroleum fuels, and 5 percent from electricity. Out of this, the urban share is more than 75% from the total urban energy consumption about 65 is utilized for household purpose.

5.5 Historical, Cultural, Religious and Archeological Resources

There is no reported historical or archeological resource in the project area. During the field visit the Consultant do not encountered site of historical, cultural, religious and archeological importance located near to the project area. Enquiries to residents in the area have indicated that there are no known sites of historical or archeological significance in the vicinity of the proposed project site.

CHPTER 6: ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

6.1 General Consideration

6.1.1 Overview

This part of the report addresses potential impacts associated with the proposed project and measures for both mitigating (i.e. avoidance, reduction, or restoration of) negative impacts, and enhancing (i.e. improvements of) positive effects of the Soap and Detergent Manufacturing project.

As it will be justified in the 'Environmental Scoping' part, the major positive impacts of the proposed project are mainly the economic and social benefits that can be acquired at the national, regional and local level. On the other hand, the major adverse impacts of the proposed project arises from generation of processed wastes, use of different types of chemicals, use of natural resources and employee's heath impact. Among the adverse impacts environmental pollution (particularly work area air quality degradation) as well as discharge of waste water are the main concerns associated with the project.

Cost-effective and environmentally sustainable techniques that can mitigate the adverse impacts will be proposed. Emphasis is given in selection of best available techniques (BAT) and practices for preventing and reducing of the discharge of processed wastes to the environment.

Special consideration is given to the sustainability of the proposed project through integration of best available pollution prevention technique (e.g. reusing and recycling of process wastes and by-products) at each stage of the production process without compromising the economic and social benefits of the project. Consideration is also given for those parameters stated in the provisional industrial pollution control standard. Based on the standard requirement a suitable wastewater treatment plant is proposed and a preliminary design data and operational requirements is given (Please Refer the attached drawings of the recommended wastewater treatment plant).

6.1.2 Scoping Significant Environmental Impacts

Even though the environmental impacts of manufacturing plant projects like the Shemu Soap and Detergent Manufacturing Project characterized by short term construction phase impacts and

long term impacts during the operation of the factory; the coverage of the environmental topics varies. The scope and depth of particular analyses depend upon an environmental scoping, and the availability of data.

On the other hand, to obtain the information required in the environmental assessments, the use of measurement methodologies and techniques is important, as they make it possible to adequately predict, identify, and interpret impacts on different environmental components.

In the aim of identifying significant impacts of the proposed project and to quantify them; an environmental scoping conducted. As the measurement of specific environmental variables implies selecting the methods and techniques most suited to the affected environment, the type of activity to be undertaken, and quality of information, based on impact measurement criteria; either quantitative or qualitative, the environmental scoping was conducted based upon:

1) Primary and secondary objectives of the proposed project and the rationale for its implementation
2) Environmental aspects of the project; i.e. inputs and activities of the project (energy, water, raw materials and auxiliaries) and outputs (wastewater discharges, air emissions, solid waste, other releases); and through readings.
3) Observations on the site and consultation with employees working in the factory already getting operational and with the public residing in the vicinity of the factory.
4) Applicability of Environmental policies and regulations (e.g. Provisional emission limit standards)
5) Consultation with local experts and reading

The scoping exercise indicated that major positive impacts of the project are mainly those of economic benefits at the national, regional and local level, creation of employment as well as technological capacity building for the citizens, while the major adverse impacts are associated with the generation of wastes at different stages of the production process. Even though, it is short term, reversible and localized in nature the construction of the factory might have also an adverse environmental impact. However both its nature and characteristic makes the impact less significant.

Based on the scoping process particular attentions have been given to the following environmental issues:

- Induced industrial development in the area
- Generation of industrial process wastes
- Consumption of natural resources
- Alteration of soil structures and integrity of landscapes due to construction
- Employee's health hazard and industrial safety

6.1.3 Potential Impacts Characterization and Classification

The environmental impact from each identified potential environmental issues of the project not only can be more than one but sometimes it can amplifies or depress the impacts from the other environmental issues. Therefore, in order to predict and study the environmental implications of each potential environmental issue identified in the scoping, the potential impacts of each environmental issues are characterized in the following way:

a) The beneficial or detrimental character (i.e. positive or negative) of the impact with regard to the situation prior to the action.

b) The magnitude represented by extension, quantity, and intensity of the impact. For instance, it answers questions such as what is the volume of pollutants or percentage above the standard limit, etc.

c) The significance of the impact and its relative importance (impact quality). For example, intensity of effluent toxicity or environmental value of a land area.

d) The type of impact; i.e., direct, indirect or synergistic (the latter accumulates and increases with the presence of several impacts, which end up exceeding the sum of the individual impacts).

e) The duration of the impact refers to the behavior of predicted environmental impacts in time: whether it is short-term and then stops; whether it appears rapidly; if it is long term or intermittent, etc.

f) The reversibility of the impact, which considers the possibility, difficulty, or impossibility of returning to the situation previous to the action or project. There are reversible, terminal, and irreversible impacts.

g) The impact risk and its probability of occurrence.

h) The spatial area or area of influence, the land area receiving the environmental impact, which does not necessarily coincide with the location of the proposed action. It informs about the dilution of the impact intensity, which is not lineal to the distance from the source that induces it; when environmental characteristics are more sensible, the impact severity will increase (the example of toxic accumulation in ravines with impermeable soils is relevant).

The subsequent section of Chapter 6 discusses potential impacts of the project associated with the above environmental issues of the project by characterizing as beneficial and adverse impacts.

I. Beneficial Impacts and Proposed Measures for Enhancement

The establishment of this soap and detergent factory will have a number of positive impacts on both at the national and local level. Some of the major positive impacts include technological capacity building, economic development and creation of employment. These potential positive impacts, their origin and characteristics presented below.

6.2 Economic Benefit

6.2.1 Contribution to National Economic Performance

Impact Origin and Characteristics

The implementation of the project has an array of economic benefits. It transforms raw materials to a higher value, provides consumer goods, produces development goods for other sector, generates employment, promotes skill development and disseminates technological changes.

As the factory uses advanced technology for the production of detergent, it will serve as import substitution factory to replace imported detergent products. Thus, the project can preserve the country's foreign currency that can be used for importing of these goods otherwise. In addition to producing import substituting goods, the factory will play important role in attracting other people to establish similar factories which are producing intermediate goods that are used by soap factory as input.

As it was plainly stated in the objective of the project, the project developer will generate financial benefit in the forms profit that to be used for saving and family consumption when the project get operational. To this effect, it is estimated the project owner will receive an average of 57.5 Million Birr every year in the form net profit beginning at 5th year of the project and throughout the project live time. Dire Dawa City Administration and Federal Government also will share the benefit of the factory by collecting revenue in the form of income tax, profit tax and VAT. With this regard, the factory is estimated to generate an average of 32.9 Million Birr/year in the form of profit tax only beginning at the 5th year of the project and that to be reinvested for the benefits of the nation.

Beside above briefly discussed induced financial and economic development contributions, the project will be an opportunity for the introduction of new technologies to the county. Since the industry is a technology intensive enterprise, which involves many industrial technologies, it is believed that the project will add additional knowledge to the local manufacturing industry and at the same time it will create the opportunity and exposure to the local experts on the sector.

Benefit Enhancement Measures

Executing the proposed project in the manner it benefits the country at large (example: production of quality soap and detergent products, introduction technologies that maximizes the product yield as the same time reduces the environmental burden of the production process) is the proposed benefit enhancement measure.

Participating local professionals at different stages of the project will enhance capacity building in the sector. This is also an opportunity to minimize operating costs and professionals can be readily available locally for maintenance and expansion activities.

6.2.2 Employment

Impact Origin and Characteristics

The direct and indirect employment opportunities to be created for citizens are t other economic benefits of the project beyond those economic outputs discussed above.

The feasibility study of the project indicates that, the factory will create direct job opportunities for more than 261 workers out of which 150 are casual workers, who are from local people

residing near by the project area and from Dire Dawa town. Thus, the project will be an opportunity for the town by lightening the brunt of unemployment in the town to some extent. In addition to this long term employment opportunity, the construction stage of the project will have a short term employment opportunity, particularly for the local laborer.

An indirect employment is also expected at each stage of the project. As the project expected to have interactions with local product dealers and service providers, indirect employment to be created from the project is indispensable.

Benefit Enhancement Measures

Special consideration is given to enhancement of the positive effects of the project by maximizing the distribution of this employment related project benefits.

Hiring professionals and service providers will be based on merits and yet on competitive base in order to get quality technical workers, it will enhance the benefits of project to give especial consideration for the people residing near by the project sit to provide them with job as priority for those positions not requiring especial skill. During construction phase of the project as, there will be high demand for daily laborers; it will be twofold advantages to hire laborers from local people. At first place, the project promoter will reduce time of searching for laborers and save his money that is needed for transporting of these laborers to project sit and in second place, fairly distributing the benefits of the project will enhance project social acceptability in general

In addition to the above proposed measures that can enhance the direct employment benefits, procuring supplier and services from local sources to the maximum extent possible at each stage of the project enhances the indirect employment opportunity of the project.

6.2.3 Investment

Impact Origin and Characteristics

The establishment of manufacturing industries like the proposed Soap and Detergent Factory requires high level of investment, particularly for purchasing of processing equipments, erection of the factory production units and installing of utility systems. The feasibility study of the project indicates that the proposed project requires an initial investment of 90.7Million Birr It will have a significant inducing power for establishment of other similar projects as backward

and forward linkages. It will also play great roll in strengthening the investment capacity, most importantly at Dire Dawa level.

Benefit Enhancement Measures

Complying with public and private requirements and producing goods at low costs of production maximizes benefits from the investment. Although, they require effort of external institutions and governmental bodies, facilitating the investment process enhances the benefit.

6.3 Social Benefits

6.3.1Local Income Generation and Livelihood Improvement

Impact Origin and Characteristics

The employment opportunity to be created by the project will have social benefit beside the expected economic benefit. The employment income from the project will have a substantial role for social livelihood improvement in the project area. This local income generation related social benefit will have long term as well as cumulative benefits:

Benefit Enhancement Measures

Utilization of the available labor force in the area enhances the benefits at local level. Out sourcing commercial activities like cafeteria services for local competitive service providers maximizes the social benefit of the project.

6.3.2 Gender Equity and Employment Opportunities

Impact Origin and Characteristics

Women efficiency in carrying out some of the production processes (e.g. product packaging, process control and sorting of product defects) make them preferable for the industry. This gender specific opportunity will address the historical disproportionate burden of unemployment on woman.

Benefit Enhancement Measures

Consideration to be given for keeping the above beneficial opportunity the project provider to women and actions to avoid work area problems women can face. The actions to be taken include:

- Providing equal work opportunity
- Strict rule on work area sexual harassments.
- Job security
- Appropriate payment (equal payment standard with men engaged on equivalent work load).
- Medical and reproductive health follow-up for women'
- Joint counseling service RH and HIV Aids for the needy employees.

II). ADVERSE IMPACTS AND PROPOSED MITIGATION MEASURES

The proposed expansion project is characterized with insignificant negative impacts of short term construction phase and long-term operation phase. This section of the report outlines these adverse impacts and presents the proposed prevention and mitigation measures.

6.4. Construction Phase Negative Impacts and their Mitigations

The construction phase of the project involves clearing, land leveling, transportation of construction materials, erection of machineries, and installation of utility systems (including boiler) etc.

Potential adverse impacts associated with the activities of the project are:

- Alteration of vegetation, landscape and land use pattern
- Impact on Water Resources
- Impact on Air Quality
- Impact on flora and fauna

6.4.1. Alteration of vegetation, landscape integrity and land use pattern

Impact Origin and Characteristic: Land clearing and leveling as well as dumping of excavated material can be a cause for the alteration of landscape integrity in the project area. With a 3-5 cm thickness land clearing requirement and reduction of the existing 7% gradation to 2-3% slope requirement; the land clearing work involves moving of an estimated 900-meter cube of soil. Even though the activities can be a possible impact origin for alteration of landscape integrity;

from the existing environmental features of the project area point of view the impact from land clearing and leveling will not be significant. Both from the scale of the project and the reversibility of the impact with application proper mitigation measures perspective, alteration of the landscape integrity due to dumping of excavated material is not significant as well.

Construction of the factory buildings and utility systems is the other potential cause for landscape modification in the project area. But as the setting of the factory will not interfere with the scenic value of the landscape (for example it does not obstruct the panoramic view of the rural landscape, waterfalls, or mountains) the impact is not significant. In addition to this, the site does not have any interference with any traditionally important feature of landform.

Concerning the impact of the project on the change of the existing land use pattern; as the proposed project will change the land use from shrub and bush encroached area into high value intensive industrial manufacturing, the issue is not a concern at all. In addition to this land is a public property in Ethiopia.

Mitigation Measures: Though those described impacts are not significant they can be avoided by undertaking the following mitigation measures:

- Restoration and maintenance of lost shrubs and vegetation covers by planting suitable tree species as a hedge around the premises
- Grade limitation to avoid spoiling scenery and view lines with earthworks
- Dumping excavated material at selected suitable site and re-shaping it with the dumping site
- Creating awareness on the value of conserving biodiversity in general and indigenous species in particular among the workers engaged on the construction activity
- Minimizing the movement of vehicles and construction machineries particularly outside the premise of the project site to avoid the distraction of road side vegetation cover

6.4.2. Impact on Water and Other Natural Resources

Impact Origin and Characteristic: Although it will be much lower than that of required for the operation phase of the project, the construction phase of the project requires a relatively high volumes of water which will have a substantial impact on the developed groundwater sources in the area. In addition to this, during the construction phase of the project foreign materials like oil, grease, fuel and residues of derbies can be originate. The materials are potential threats for water quality degradation. However, the problem is not significant; since the bore hole is located on the other said Maleka Rode

Alteration of the natural water cycle is the other water resource impact in relation to the construction phase of the project. But the impact is not an issue here, as there is no surface water resource in the area that can be impacted by the proposed project.

As the project comprises the construction of buildings, and other structures to be used for different purposes; the project will have pressure on existing local construction materials including sand, masonry stone and soil resources. However both from the scale and character of the project point of the impact is less significant. In addition to this, as the project uses pre-fabricated building materials (like hallow blocks) for the construction of the factory buildings; the impact is not an issue for the project.

Mitigation Measures: The following measures mitigate the impacts:

- Limit water withdrawal to the amount that will not adversely affect the ecological balance and the demand of the local community, such as by developing and conserving own source of water.
- Efficient utilization of sands and stones coming from authorized query site
- Contribute to the rehabilitation of quarry site by paying in the price for the quarry goods from an authorized site

6.4.3. Impact on Air Quality

Impact Origin and Characteristic: Local land degradation due to earth moving operation of site preparation and land leveling is the main air quality concern of the project on the

construction stage of the project. As the impact that can arise from the problem is localized, the contribution of the project construction to air quality degradation is not significant. However, as the dust storm can have visibility impact on site operation and decrease breathing because of the suspended particles in the air, the problem is an important issue that requires consideration.

Mitigation Measures: The practical option to avoid local land degradation due to dust emissions that can arise from construction activities is to sprinkle water on fresh construction spoil. In addition to this, instructing the site workers on the procedures of construction and safety precaution prevents the consequence of visibility loss during operation of construction machineries.

6.4.4. Impact on flora and fauna

Impact Origin and Characteristic: Stripping of vegetation and cutting trees and introduction of plants that are foreign to the environment will affect the biodiversity of the immediate area. Potential impacts include those associated with the loss of plant communities, increase in natural instability of plant communities. However, because the project site is characterized by a scattered shrubs and bushes, de-vegetation of native vegetation cover is minimal. The project site has neither a recognized wildlife habitat nor an important ecosystem of indigenous plant species, and therefore the construction phase has minimum impact on flora and fauna

Mitigation Measures: Though the impact on vegetation loss is minimal in order to avoid vegetation damages during the construction activities and the project keep the greens of the environment; the following measures are recommended:

- Limit clearing and soil disturbance around construction sites
- Limit and control movement of trucks and construction machineries during construction
- Prepare green areas by planting grasses and other trees in empty land of the premise in order to be an example in keeping the environment
- Create an awareness for the local people and workers in every opportunity about the importance of vegetation cover for soil and water conservation

- Grade disturbed areas and restore landscape

6.4.5. Nuisance Noise

Impact Origin and Characteristic: Construction involves the operation of machinery and vehicles. As a result some noise pollution is expected in and close to the project site. However because of the scattered settlement in the area, the noise impact on the local population is not significant. The operation is conducted during daytime where most of the people are in the field. There are no institutions sensitive to noise such as schools, health institution or other offices close to the project site.

Mitigation measures: All equipment to be employed for the plant will be designed to operate with low noise levels, and will not exceed the maximum allowable noise level for the surrounding receiving land use. And since the construction doesn't involve the use of explosives or blasting, it does not entail significant noises that affect human population or wild lives of the project area.

6.5. Operational Phase Adverse Impacts Identification

6.5.1. Background: The Approach

The operational phase is the main environmental issue of the project. In assessing these impacts, the Consultant preferred to follow an approach that provides realistic background information on the environmental assessment process. The approach considers the brief description of the work place, the environmental aspects arising from the operational phase, the respective environmental impacts and the viable (both environmentally, technically and economically) mitigation measures.

6.5.2. Description of the Work Environment

Environmental aspects of the project that cause adverse environmental impacts are heat stress at boiler houses, heat exchangers and dryers; emission of particulates and acid fumes from production units and generation of nuisance noises from operation of production units. Accidents and work area hazards are the other work environment aspects of the project.

Environmental pollutants from services and utility units include boilers, workshop laboratory, and garage as well as warehouses is the main source of environmental pollutants concerning service and utility units of Soap and Detergent factory.

Boiler: In soap and detergent industries, boilers are necessary for steam generation. Steam is used for heating, stripping, or as primary fluid in jet ejectors. Fuel is burned in boilers to convert water to high-pressure steam. The gaseous emissions, due to boilers burning fuel oil contain primarily particulates and carbon monoxide.

Wastewater is also generated due to the blow down of boilers to keep the concentration of dissolved salts at a level that prevents salt precipitation and consequently scale formation. The blow down will be high in (TDS). Furthermore, substantial amount of water is used for cooling, which pollutes the discharged wastewater. The amount of wastewater generated depends on whether cooling is performed in open or closed cycle and on the recycling of steam condensate. In case Shemu Soap and Detergent factory the steam is cooling in open cycle which is resulted to discharge condensed steam in the environment. Contamination may arise from lubricating and fuel oil. The steam condensate from the production processes discharged as wastewater causing pollution source to effluent.

Laboratories: Laboratories, in oil & soap industry, are responsible for testing chemicals and wastewaters to check compliance with required standards, controlling the quality of products to check agreement with standard specifications as well as checking the physical and chemical properties of products based on the standards.

In this regard, chemicals, including hazardous materials, are used in laboratories. Storage and handling of these chemical can result for spill and leakage entry to the wash water system or storm runoff.

Workshops and Garage: Workshops are very important in most industries, where they are divided into mechanical and electrical, mostly responsible for repairing and maintenance of the factory equipment. Environmental violation could be due to Noise and Rinse water contaminated with oils and greases.

Warehouse his refers to the large buildings in which raw materials are stored. Possible pollutants from the warehouses include solid wastes like empty containers of raw materials and chemicals contaminated with traces of chemicals.

6.5.3. Identification of Environmental Aspects

The environmental aspects of Soap and Detergent production process are related with the generation of environmental (both the bio-physical and human) pollutants. Generally, these environmental pollutants can arise from the production process and services and utility units of the factory.

There are both environmental pollution sources and human health hazards that can be caused by the production process of Soap and Detergent manufacturing. These production process environmental aspects can be summarized as:

- Waste water effluents
- Solid wastes
- Air emissions

6.5.3.1. Wastewater Effluents:

The major pollution loads of the soap and detergents industry is the waste water from the various sources. Liquid effluents are generated from equipment, vessels, tanks, process and cooling water and washing of products, equipment and floor. The major constituents of the wastewater effluents are oil and grease (O&G), BOD, COD, synthetic detergents, pH, and TDS. Specific effluents include wastewater effluent from the production of soap bar. The wastewater from these processes arises from washing the production rooms' floors. The contaminant of the floor wash water is soap which will contribute primarily to BOD and COD.

6.5.3.2. Air emissions

There are different sources of air emissions in the soap and detergents industry. These include those from the saponification process as well as from the variety of heaters and driers in the soap and detergents production processes.

- CO2 emissions results from the major heat sources, such as the oil furnaces;
- Particulate matter (PM10) resulting from boilers and soap and detergents drying and conveying processes and;
- Fugitive emissions, volatile fatty acids, aldehydes and ketons in deodorization and hot well; benzene and kerosene from distillation tower in detergents unit.

6.5.3.3. Solid Wastes

The main sources of solid wastes are:

- Empty containers of raw materials and chemicals contaminated with traces of chemicals;
- Spent catalyst, which is considered as hazardous waste;
- Spent filter cloth contaminated with oil and;
- Spent fuller's earth contaminated with oil.

6.5.4. Analysis of Impacts and Proposed Mitigation Measures

The Consultant's impact analysis indicates that: Environmental pollution (air, water and soil); employees' health hazard; natural resource depletion (water and energy); generation of solid wastes and impacts on socio-cultural and socio-economic factors are the main environmental impacts of the operation phase of the project.

Checklists, matrices (including modified Leopid Matrix) were used to analyze the relation between those identified environmental aspects and the impact they can induce on the environment. Apart from this, the Consultant has made use of past experience cases and employed experts' knowledge for the analysis.

6.5.4.1. Impact on land and soils

Impact origin and Characteristics: Industrial waste water effluents from the production processes of the factory are the significant water quality problems. The provisional industrial pollution control standard prepared by Environmental Protection Authority of Ethiopia (EPA) has set limits for the pollutants in the wastewater discharged into the environment. In this standard, the parameters of relevance to the Soap and Detergents industry are PH, BOD, TDS and Fat, Oils and Grease.

The standard sets an emission limit value for the wastewater discharge based on two scenarios for discharging the wastewater effluent which are:

- wastewater effluents standard for discharging to inland waters
- standard for controlled application of the wastewater effluent to land

The wastewater from Soap and Detergent is high in organic content, resulting in biological oxygen demand (BOD) of 2,000-3,500 mg/l and a chemical oxygen demand (COD) of 30,000-60,000 mg/l. In addition, the wastewater is highly polluted with dissolved solid (5,000 mg/l), oil and fat residues (500-1,000 mg/l), organic nitrogen (500-800 mg/l), and ash residue (4,000-5,000 mg/l).

Based on the basic constituent groups of concern parameters stated in the standard, the wastewater effluent of the production process as compared to the standard are expected to have the following average values.

Table 5: Expected Average values of wastewater with respect to the standard constituent values

No	Constituent Group or Parameter	Estimated Average Value (mg/l)	Standard Emission Limit Value (mg/l)	
			Controlled Application to Land	For discharging to inland waters
1	Ph	11.2	5.5 – 9 pH units	6 – 9 pH units
2	Biochemical Oxygen Demand at 20°C	2,400	500	80
3	Total Dissolved Solids (TDS)	5,000	2,100	3,000
4	Fats, Oils and Grease	700	30	20

As illustrated in the Table 5 ; the quality of the wastewater from the production process is above the stated two standards. Thus, the wastewater effluent from the production process of the project should not be discharged to the environment prior to treatment.

Beside this, discharge of high O&G, BOD, and COD loads to the public sewer system will have an indirect environmental impact. Spent grease and oils from garage and workshops could be a cause for concern if discharged into the sewer system because they tend to coat surfaces causing maintenance problems. Also, they can be entered the environment as runoff if they are discharged to environment. In addition, spent acids and caustic wastewater could make corrosion of the internal sewer system of the plant, if simply discharged.

Mitigation Measures: Utilization of the best available technologies together with the adoption of Cleaner Production techniques is the first mitigation measure to minimize the generation of these process wastes at their source. However, as indicated in Table 6.1 the physico-chemical properties of the effluents are higher than that of the country's emission limit values. Thus, in order to bring the final wastewater effluent up to a standard with the provisional wastewater discharge limit, a wastewater treatment plant is also recommended for the project.

As there is no surface water resource in the area and the intention of the proponents is to treat and re-use the wastewater effluent for irrigating the green park of the factory; treating the waste water effluent and bringing all water quality concerns below emission limit values for controlled application for land stated on provisional environmental emission standards for Ethiopia is the mitigation measure.

As it was mentioned above the wastewater effluent from the soap and detergent plants is characterized by high levels of BOD, COD, and Oil and Grease, the wastewater effluent could be treated using;

- High efficient oil and grease traps
- Dissolved air flotation (DAF) unit
- Biological treatment unit

In selecting the unit operations to be used for the wastewater treatment plant, in addition to the above unit's consideration also given to the following issues

- In case of semi-solid waste materials are present in wastewater, mechanical skimming is used.
- Reduce the pollution load discharging from the saponification unit by collecting the wastewater in pan and treating with fat to neutralize the caustic soda, boil with steam and allow settling.
- Hot spent lye with some soap due to inefficient separation causes overflow of foam on the floor, which is usually washed down causing problems in wastewater (inability of biological treatment). The solution is feeding the hot spent lye to a saponification unit with a predetermined amount of fatty acids to form soap.

Therefore, the proposed wastewater treatment plant comprises the following main units

1) Bar screens for removing foreign materials (like rugs and filter clothes) from all the wastewater effluent lines
2) Mechanical skimmer for removing fat and grease from the fatty acid production and neutralization sections

3) Flow equalization tank for the homogenization of the wastewater effluent from the different sections
4) Intermediate holding tank
5) Dissolved Air Floatation (DAF) unit for removing
    a. remaining fats, oils grease and emulsified fat
    b. suspended soap and detergents products
    c. settable suspended materials
6) An aerobic digester for removing remaining BOD and COD
7) Flocculation and Sedimentation Tank for removing the sludge from the biological treatment unit

In the detail design and operating the waste water treatment plant, consideration should be given for the following:

- Detail waste water constituent characterization for each waste water stream, compatibility of streams and identifying the important constituents of concern in each stream.
- Estimate average wastewater flow rates from each source and consider some possible pollution prevention and source reduction options for the different waste water sources.
- Select methods and processes to remove the identified constitute of concern in each wastewater stream. The selection should consider the following factors:
    - Process applicability
    - Applicable flow rate
    - Applicable flow variation
    - Influent wastewater characteristics
    - Inhibiting and unaffected constituents
    - Climatic constraints
    - Methods for sizing the process units (mass transfer or wastewater loading, reaction kinetics or waste water loading)
    - Performance
    - Treatment residuals
    - Sludge processing

- Environmental constraints
- Chemical requirements
- Energy requirements
- Land availability, etc

End of Pipe

Apart from this end-of-pipe industrial wastewater treatment technique, the following measures prevents or minimizes the generation of wastewater from production activities and/or the degree of the environmental impact and impact controlling cost.

- Segregate wastewater effluents of different sources
- To reduce the amount of BOD, SS, and other left over constituents, clean equipment and floors mechanically prior to washing
- Use high pressure spray systems for washing floors and process equipment

High pressure washing reduces 80-90% of the amount waste water generation.

- Capture as much unused and spilled raw materials and products from floors before cleaning
- Recycle cooling water as much as possible
- Indiscriminate use of water for cleaning or washing in all areas of the production process
- Drainage prior to cleaning in process tankers
- Develop technologies for the possible reuse of wash water
- Operator training for efficient use of resources.

6.5.4.2. Impact on air quality

Impact origin and characteristics: The project uses boiler in order to satisfy steam requirements for drying process and other purposes. Heavy furnace fuel with a calculated heating value 960 kJ/kg will be oxidized with primarily filtered atmospheric air. During this oxidation processes there will be generation of both direct and side product gases. The Carbon and Hydrogen from the fuel converts to CO2 and H2O vapor, depending on the operating temperature of the boiler, Nitrogen which comprises 79 % of the atmospheric air oxides to different nitrogenous oxides (NOx); sulpher from the furnace fuel (usually 2-3% by weight)

oxidizes to SO2 and incomplete oxidation of fuel due to air deficiency produces CO. The reactions

$$C + O_2 \rightarrow CO$$

$$H_2 + O_2 \rightarrow H_2O\ (g)$$

$$N_2 + O_2 \rightarrow NO_x$$

$$S + O_2 \rightarrow SO_2$$

The other atmospheric pollution problem in soap manufacturing is odor. The storage and handling of liquid ingredients (including sulfonic acids and salts) and sulfates are some of the sources of this odor. Vent lines, vacuum exhausts, raw material and product storage, and waste streams are all potential odor sources.

Blending, mixing, drying, packaging and other physical operations may all involve particulate emissions.

Generation of particulate matters from the combustion process is minimal. However lack of proper cleaning programs for boiler and flue gas stack creates accumulation of ash residues, solidified gas condensates: like SO2 in the system. During startup and blowup due system disruption, these accumulated solid particles can be washed away with pressure and enter the atmosphere.

In this context, a detailed analysis of the potential atmospheric emissions from the proposed project was undertaken for the proposed expansion project. This analysis addressed the emissions to air which may occur during the normal operational phase as well as the minor emissions of fine particulate matter from other process stacks. The aim of this analysis was to assess the effects of these emissions in terms of ground level pollutant concentrations at ground level. These changes in local air quality were then compared with the local standards and World Bank guidelines.

Table6: Expected Average values of air emissions with respect to the standard constituent values

Compound	Expected Average values[$\mu g/m^3$]	Guideline Value [$\mu g/m^3$]	Averaging time
Sulphur dioxide	17.996	125	24 hours
Nitrogen dioxide	0.245	40	1 year
Carbon monoxide	470.06	10 000	8 hours
Suspended Particulate Matter (PM_{10})	162.3	150	24 hours

Table 6 demonstrates that the quantities of the air emissions from the production process are below the stated standards. In this context, the expansion of the soap and detergent manufacturing facility will actually contribute insignificantly to the overall air quality.

Mitigation measures: Control of the odors associated with the production process may be achieved by scrubbing exhaust fumes and, if necessary, incinerating the remaining volatile organic compounds (VOCs). Odors emanating from the spray dryer may be controlled by scrubbing with an acid solution.

Particulate matter emissions from other finishing operations can be controlled by dry filters such as bag houses and cyclone separators. Generally, these mechanical separators are used, not only to reduce or to eliminate dust emissions from detergent production units, but also to recover raw materials. Thus, bag filters and cyclones are an integral part the technology of the soap and detergent production processes.

Dry cyclones and cyclonic impingement scrubbers are the primary collection equipment employed to capture the detergent dust in the spray dryer exhaust for return to processing. Dry cyclones are used in parallel or in series to collect this particulate and recycle it back to the crutcher. The dry cyclone separators can remove 90 percent or more by weight of the detergent

product fines from the exhaust air. Cyclonic impingement scrubbers are used in parallel to collect the particulate from scrubbing slurry and to recycle it to the crutcher.

Reducing the formation of CO, NO2, and SO2 during the combustion process is the primary measure to mitigate air quality impact from the combustion process of the project. Approaches recommended to minimize the generation of these gases include:

- Use automated fuel feed controlling valves and pumps
- Use an efficient air-fuel mixing device
- Use air deficiency indicating alarms
- Using fuel having less SO2 content & revise the specification fuel quality
- Operate the boiler keeping suppliers specified air: fuel ratio
- Avoid suspended solids from the air stream by primarily filtering
- Programmed boiler operation to reduce startup and shutdown of boiler
- Control boiler temperature in order to prevent unwanted side reactions

Human health and other environmental impacts due to the presence of the different gases in the boiler exhaust gas near the ground level require proper mitigation measure. Since none of the exhaust gas constituents above the stated emission limits from combustion source, transporting and diluting the combustion exhaust gas to higher altitude using stack alone mitigates the impact.

The following measures need to be considered to make the stack an effective mitigating tool:

- Setting the stack height factor by considering wind speed and direction; altitude; climate, landscapes, position of sensitive areas
- Putting thermal and wear resistance materials inside the stack especially at the inlet of the flue gas protect the stack from frequent wear & damage.
- Rather than installing one long stack, connect a couple of short stack units to easily maintain, clean and inspect the stack.
- Provide small inspection widows and usually clean the stack inside
- During boiler stoppage intensively clean and remove all condensed solids from the stack before restarting.

- Provide or create the means to provide the stack emission measurement devices in order to comply with future emission regulations and standards

6.5.4.3. Impact on Solid Waste related environmental pollution

Origin of Impact an characteristics: The production process of the proposed project is characterized by the generation inevitable but less amount of solid wastes: Empty containers of raw materials and chemicals contaminated with traces of chemicals, Spent catalyst, which is considered as hazardous waste, Spent filter cloth contaminated with oil, Spent fuller's earth contaminated with oil product packaging are the major solid waste issues of the production process of the project.

Although solid waste may be less significant problem in qualitative and quantitative aspects, it will have considerable environmental risks, if it is not managed properly. Storing of solid wastes generated from the production process in open areas inside factories, which is the common practice, will have a direct impact on the land which is the main receiver of solid wastes. Common problems associated with these practices include:

Spontaneous ignition of spent Fullers Earth: This can occur either in the factory or in the dumpsite and is a severe fire risk. The risk can be increased by the proximity of hazardous or highly flammable materials. Associated with the risk of fire is the generation of dust and ash, the spreading to adjacent areas, damage to property and goods.

Poor disposal of oils: Oil that is stored or disposed poorly may soak into the ground which can putrefy and make it slippery.

Aesthetic appearance of storage or disposal land: It is common that empty barrels, scrap, general refuse stays for long times in open storage areas within the industrial facility, which encourages the presence of pests such as rats, mice and cockroaches and also makes the factory appear unsightly and unappealing to visitors.

Mitigation measures: Preventing and minimizing the generation of the solid waste at its source is the primary measures to mitigate the impact they can induce on the environment. In general the following abatement measures reduce solid waste related environmental pollution problems:

- Raw material input has to be converted immediately to produce lowest grade soap.
- In the soap production plant, pipelines carrying molten soap should be steam jacketed. If pipelines are not adequately protected & power cut occurs, the soap will cool rapidly, solidifying and clogging the whole system. Use of an emergency generator in case of power cut off.
- Any waste is recovered and recycled to the saponification unit, through a closed loop operation system.
- Reduce soap dust losses by the following procedure:
    - Charging the rubber gasket in the powder precipitator regularly to reduce the leakage.
    - Recovery of soap dust from the floor using vacuum cleaner.
    - Collection of soap dust in the work place using dust collector
    - Discharge the contents of the powder precipitator directly to the powder soap unit by mechanical rather than manual means.
- Salt separated from glycerin unit should be used in soap production only and should not be used in other purposed.
- Recovery of solid ingredients; animal fodder production unit is characterized by heavy dust emissions. This result in losses, clogging of machinery and generating unpleasant working conditions. Cyclone vacuum system could be used to recover particulates and recycle them to raw materials intake system.
- The used fuller earth may be used as conditioner for sandy soil to increase its water retention.
- Volatile fatty acids escaping from the deodorizer will accumulate on the surface of the hot well, and could be skimmed off manually or using traps/separators, could be used as an animal fodder constituent.

- Pitch formed in the fat splitting into fatty acids may be used as a waterproofing or paving material.
- Aluminum soap formed in glycerin plant can be used as metallic soap.
- In oil hydrogenation process, particulates of Nickel catalyst should be removed from the synthetic butter through filters clothes (clothes of cotton) and garckaskeen filter papers. The collected Nickel particulates should be safely disposed into a landfill.
- Scrap metals are collected and sold.
- Off cuts and scrapes from the manufacture of cans can be pressed and sold to metal processing factory.
- Damaged plastic bottles & cartons can be collected & sold for recycling.

6.5.4.4. Impact on Employee's Health & Other Risks

Impact Origin and Characteristics: Since a work place is a potentially hazardous environment, workers encounters direct, indirect and long-term potential health problems during the operation of the proposed project.

According to the information obtained from the employees' interview conducted as part of the EIA study; it was found that Boiler operators have a chance of exposure to high heat and rapid changes in temperature. Those workers responsible to supervise, control and operate the production processes of the factory are exposed to muscular fatigues in climbing tanker ladder floor steps. In adequate illumination of rooms and working areas causes a number of detrimental effects on workers. Workers directly involving in dosing, mixing and handling chemicals have the opportunity to inhale toxic chemicals. Production and technical personnel have the exposure to continuous noise and vibrations created from fluid driving machines (like: pump, blower, compressor); electrical motors and machineries.

Inhaling of the emissions results from the various operations of the production process (e.g. Soap and detergents drying, packing) are potential workers' health threat.

Beside those expected the project health issues; there are accidents caused employee's health issues. Though they can cause chronic health impacts, most of these potential impacts are acute in nature (e.g. body injury).

Back fires on boilers and sparks around fuel tanks can cause more than workers health problem. It destroys property. Explosion of tankers and pressurized cylinders are not only potential risks for the nearby worker but they are also causes for other hazardous; including fire. Interference of technicians and operators in running machine parts like: cooling fans, hydraulic presses can cause body injury. Interference of individuals with electrical systems, failure from structures and failure due to slippery floor are other causes for injury. Direct body contact with acids and alkali chemicals causes damages body tissue.

There are some environmental risks which are specific to manufacturing process of soap and detergent. The main environmental risks are associated with the following activities:

Storage and utilization of hexane: In most factories, this is stored and used in adequate and safe conditions. However, the consequences of any accident related to such highly flammable material may not be limited to the factory premise, but cause significant damage in the surrounding environment. This will be of particular concern when the factory is located in residential areas.

Storage and Utilization of Fuel: The storage of fuel may also have risks, mainly in terms of land and water contamination. This is particularly evident in soap and detergent factories, boiler areas are usually heavily contaminated with fuel. Above-ground storage of fuel may also pose risks with regard to leaks to underlying processes which may act as ignition sources.

Repairs and mechanical workshop: Activities inside the repairs and mechanical workshop of the factories may cause oil contamination risks to the land, or in wastewater. In addition, there may be risks to the workers, including exposure to fumes, injury with sharps etc.

Others: General occupational health risks exist throughout the factory from noise, dusty atmosphere, or slippery floors.

Mitigation measures: Anticipation of potential hazards and risks in the work environment and implementing control methods to remove or reduce the hazard exposure of the worker is the proposed measures to mitigate the impacts under consideration:

The general control methods available for control of hazards include:

- Isolation of sources;
- Ventilation;
- Administrative controls and
- Personal protective equipment.

Isolation of Sources: Isolation of toxic and flammable materials in separate location and prohibiting smoking and welding around fuel tankers, enclose or shield sound and vibration sources using physical barriers like sound proof walls

Ventilation: Use comfort ventilation in the boiler and production areas to assure the comfort of operators in the area; remove VOCs using local exhaust ventilators, utilize local supply ventilation and natural ventilation systems in boiler house

Administrative controls: Train workers regarding work area safety and hazardous control like the fire hazardous and controlling mechanisms; application of safety and hazard control equipments; monitor the work area or the worker, good housekeeping, and preventive maintenance.

Personal protective equipment: The personal protective equipment to be considered are: skin protections (plastic gloves and aprons); eye protection (safety glass, goggles, face shield, and hood); ear protection (ear muffs); respiratory protection (air-purifying respirators); and safety shoes.

The other important factor to be considered in mitigating workers from work environment related health impacts is ergonomics. Ergonomics is concerned with the following:

- The design of tools that are used in order to match the physical characteristics of the worker with the functioning of tools
- The design of the workplace space itself to meet the physical characteristics of the worker
- The analysis and design of controls and displays to allow the worker to operate and monitor processes efficiently with minimum error
- The development of job procedure that meet the capabilities of the worker in the system

- The minimization of external forces that can act to affect the worker in the workplace; these external forces include such things as noise, thermal condition, illumination, and vibration.

Besides the above; the following measures need to be considered regarding employees' health:

- Pre-employment and periodic health checkups for workers
- Plan, facilities, equipment, and personnel for emergency response to work area accidents
- Insurance policy and procedures for work area caused damages

6.5.4.5. Impact on Energy Resources

Impact Origin and Characteristics: The production process of the proposed project requires 2,000 kg/hr steam. In order to full fill this steam requirement the factory consumes 165 lt/hr heavy furnace fuels as energy source for the boiler unit. As furnace fuel is low grade crude oil product, the proposed factory project has nonrenewable energy resource depletion impact.

The operation of the proposed factory project requires a considerable electrical energy resource for: running of machines, power for the factory, buildings, etc. As the project uses a renewable energy source hydroelectric power the impact is not significant. However, from economical point of view the issue requires attention.

Mitigation Measures: Measures that reduce furnace fuel use related impacts include but not limited to:

- Consider economizer to preheat the feed water using the boiler exhaust gas. The exhaust gas from the boiler can reach a temperature of up to 800 Oc. capturing the exhaust gas and using to preheat the feed water significantly reduces the amount of furnace fuel consumption. In addition to this the mechanism reduces the temperature of the exhaust gas.
- Reduce boiler startup and shutdown frequencies by programming the operation
- Provide the burner system an automated furnace fuel flow controller, solenoids valves, pump and alarms
- Install overflow alarms for furnace fuel tank

- Construct impermeable secondary tanker for collecting and reuse of furnace fuel spills and leakages
- Setup written procedures for burner startup, operate and shutdown.

Avoiding ideal operation of machineries and implementation of proper power use practices are the mitigation measure for reducing electrical power consumption. Installation of less energy intensive equipments (like using florescent light rather than bulbs) reduces the energy consumption. Training and reminding workers to switch off lights when leaving offices is the other managerial proposed option for minimizing the problem. Generally, the following measures help to reduce the impact:

- Train operators operation of equipment in efficient to minimize energy
- Supervise production processes in order to improve production efficiency
- Switch-off ideal machines and unused bulbs, heaters
- Construct buildings in a position where rooms easily get sunlight
- Provide interlocked control system for the generator to sawed-off itself when external power returned
- Setup written procedures for production operations
- Avoid reprocessing and reworks

6.5.4.6. Socio-Economic Impacts

Impact Origin and Characteristics: As described earlier, the project is likely to have some change to socio economic situation of the area. The livelihood of the surrounding area will gradually shift to salary-based livelihood from their participation in the project as unskilled laborers. This shift which may induce change in the life style will have a short-term to medium-term consequence.

Furthermore, employees' health hazards particularly those impacts that can rarely make workers handicap will have a cumulative socio-economic impacts. The cumulative impact of work area

caused accidents related to partial or total handicapness will have significant impact on the workers' families in particular.

Mitigation Measures: In addition those recommendations that prevents the root cause of the impact (i.e. preventing and controlling work area health hazardous); facilitating insurance policy and procedures for work area caused body damages particularly for permanent workers are the proposed mitigation measures.

6.6. SUMMARY IMPACTS AND MITIGATION MEASURES

In order to provide a clear and precise understanding of the study findings which are exhaustively discussed in the preceding sections, summary potential impacts and mitigation measures, as recommended by the consultants, are presented in table 6.3 and 6.4. In these Tables, the environmental aspects, the corresponding potential impacts and recommended mitigation measures are presented for the construction phase and operational phases of the proposed project respectively.

Table 7: Construction phase of the project – Potential Impacts and Mitigation Measures

Environmental	Description of Potential Impacts	Recommended Mitigation Measures	Impact Rating
Alteration of vegetation, landscape integrity and land use pattern	• Land clearing and leveling as well as dumping of excavated material • Construction of the factory buildings and utility • Change of the existing land use pattern	• Dumping excavated material at selected suitable site and re-shaping it with the dumping site • Grade limitation to avoid spoiling scenery and view lines with earthworks • Restoration and maintenance of lost shrubs and vegetation covers by planting suitable tree species as a hedge around the premises	Moderate
Impact on Water and Other Natural Resources	• A relatively high volumes of requirement for the construction phase of the project • Foreign materials like oil, grease, fuel and residues of derbies originate which are potential threats for water quality degradation. • Pressure on existing local construction materials including sand, masonry stone and soil resources.	• Limit water withdrawal to the amount that will not adversely affect the ecological balance and the demand of the local community, such as by developing and conserving own source of water. • Make use of sands and stones coming from authorized query site • Contribute to the rehabilitation of quarry site by paying in the price for the quarry goods from an authorized site	Not significant

Impact on Air Quality	• Local land degradation due to earth moving operation of site preparation and land leveling is the main air quality concern of the project on the construction stage.	• Sprinkle water on fresh construction spoil. • Instructing the site workers on theprocedures of construction and safety precaution prevents the consequence of visibility loss during operation of construction machineries.	*Negligible*
Impact on flora and fauna	• Stripping of vegetation and cutting trees • the loss of plant communities, • Increase in natural instability of plant communities.	• Limit clearing and soil disturbance around construction sites • Limit and control movement of trucks and construction machineries during construction • Record the type and number of tree cut in order to plant again • Prepare green areas by planting grasses and other trees in empty land of the premise • Create an awareness for the local people and workers in every opportunity about the importance of vegetation cover for soil and water conservation • Grade disturbed areas and restore landscape	Not significant
Nuisance Noise	• Noise of construction machines in and close to the project site.	• All equipment to be employed for the plant will be designed to operate with low noise levels.	Not significant

Table 8: Pollutants from the production process of the project – Potential Impacts and Mitigation Measures

Environmental Aspect	Potential Impacts	Recommended Mitigation Measures	Impact Rating
Impact of waste waters on land and soils	• Discharge of high O&G, BOD, and COD loads to the public sewer system will have an indirect environmental impact	• Utilization of the best available technologies together with the adoption of Cleaner Production techniques • Construction of a wastewater treatment plant to treat the waste water effluent and bringing all water quality concerns below emission limit values	Significant
Impact on air quality	• Greenhouse gases like SO2, NO2, CO emitted to the air causes ozone layer depletion and global warming • Generation of particulate matters from the combustion and drying processes • Unpleasant odors causing work place hazards	• Reducing the formation of CO, NO2, and SO2 during the combustion process • Using dry filters such as bag houses and cyclone separators to control particulate matter emissions • Scrubbing exhaust fumes and incinerating the remaining volatile organic compounds (VOCs). Odors emanating from the spray dryer may be controlled by scrubbing with an acid solution.	moderate

Impact of Solid Waste on related environmental pollution	• Storing of solid wastes like (Empty containers of raw materials, chemicals contaminated with traces of chemicals, Spent catalyst, spent filter cloth contaminated with oil) in open areas inside factories have a direct impact on the land	• Preventing and minimizing the generation of the solid waste at its source to mitigate the impact they can induce on the environment.	moderate
Impact on Employee's Health & Other Risks	• Employees are exposed to muscular fatigues in climbing tanker ladder floor steps. • In adequate illumination of rooms and working areas causes a number of detrimental effects on workers • Workers inhale toxic chemicals • Workers' exposure to continuous noise and vibrations created from fluid driving machines, electrical motors and machineries	• isolation of toxic and flammable materials in separate location • enclose or shield sound and vibration sources using physical barriers like sound proof walls • Use comfort ventilation in the boiler house and production areas • remove VOCs using local exhaust ventilators • Use personal protective like skin protections (plastic gloves and aprons); eye protection (safety glass, goggles, face shield, and hood); ear protection (ear muffs); respiratory protection (air-purifying respirators); and safety shoes.	moderate

Impact on Water Resources	• Excessive ground water use may lower the water table & deplete water sources for future production & community use.	• Efficient use of water at each stage of the production processes	*Negligible*
Impact on Energy Resources	• Use of furnace fuel as energy source has nonrenewable energy resource depletion impact.	• Consider economizer to preheat the feed water using the boiler exhaust gas, capturing the exhaust gas and using to preheat the feed water reduces the amount of furnace fuel consumption. • Reduce boiler startup and shutdown frequencies by programming the operation	Not significant
Socio-Economic Impacts	• Employees' health hazard impacts • work area caused accidents resulting in partial or total handicapness	• preventing and controlling work area health hazards; • Facilitating insurance policy and procedures for work area caused body damages	moderate

CHAPTER 7: ANALYSIS OF ALTERNATIVES

7.1 Overview

The sustainability goal of the project can be addressed if and only if the project is environmentally, socially and economically viable. To achieve this; the Consultant considered different project alternatives and analyzed them from these three sustainability dimensions. The alternative analysis focused on environmental pollution (i.e. nuisance odor and emission of wastewater). As these environmental problems of the project are prominently related with the type of the main raw material and the technology to be used for the production process (particularly for the preparation of the soap base); alternatives regarding raw materials and processing methods for the production of soap bases on industrial scales were considered and evaluated.

In addition to these project alternatives, the no project alternative (i.e. the project area without the project future scenario) is also considered as one alternative and evaluated.

7.2 Alternatives for Raw Materials

Oils and fats are the main raw material for production of soap products. Of the many parameters that influence the environmental impacts of soap production from raw materials perspective area:

- Color and odor of the raw material
- Fatty acid composition

The following two potential fat and oil sources are considered as alternative raw material inputs for the project:

1) Alternative 1: Refined, bleached and deodorized fat and oil
2) Alternative 2: Raw Animal fat (beef or mutton fat)

Use of refined, bleached and deodorized fat and oil would reduce pollution problem. Utilizing the refined, bleached and deodorized oil avoids production process related to the oil neutralization, the bleaching and deodorization. These process are a major source of oil leaks, VOC (particularly hexane), solid waste (like gum), fuller earth contaminated with oil, gaseous

emissions and nuisance odor. Floor wash wastewater mailed effluent containing fat, oil and grease is the other major wastewater source of the three production processes.

In the case of the second alternative, in order to get a quality soap product bleaching and deodorization of the raw animal fat are an indispensable production. Thus, use of raw animal fat as main input materials for the soap production will have a significant environmental pollution. The pollution can be both due to the generation of wastewater effluent, solid waste (both hazardous and non-hazardous), and air emissions. In addition to this environmental pollution problem, raw material wastage due to storage, handling and processing of the raw fat; the utilities to be consumed in the production processes are the other environmental and economic aspects of the alternative.

Therefore, use of refined, bleached and deodorized oil and/or fat will be the sustainable alternative concerning the issue under consideration.

7.3 Alternative Technologies for Soap Base Preparation

Basically there are three processing methods for the production of soap bases on industrial scales:

1. Kettle saponification
2. Continuous saponification
3. Batch process

These three process methods were considered as alternative technologies for the production process and analyzed from environmental point of view.

Kettle saponification:

This process, once very important method of saponification and now almost obsolete, is a boiling process with live steam in deep, open kettles or pans. The pans are conical, cylindrical, or rectangular in shape, the most common type of pan being very wide, but shallow in the cylindrical part, tempering to a deep cone. Inside the pan is a distributing ring introducing live steam, and sometimes a heating coil for direct heating, together with a siphon and a swing pipe for removing the neat crud. The lye and nigre exits via mixed by the action of the steam.

Boiling kettles with stirrers have also proved useful. The cylindrical part of a kettle of this type is tall and narrow. Smaller kettles occasionally equipped with 'Crutches' in the form of perforated plates that could be removed rhythmically up and down through the liquid soap by means of rod and crankshaft assembly. Stirs and critters serve only to intensify the mixing effect. Live steam was introduced here also to induce boiling. Boiling in open kettles is effective for the saponification of both neutral oils and fatty acids.

The size of the charge varies considerably, ranging from 500kg to more than 20 tons. Large boiling kettles may have a volume $\geq$ 100m3.

Continuous Saponification Process

Efforts to shorten the processing time of the fuel boiled-kettle procedure have resulted in a number of continuous processes for soap manufacturing. These include continuous splitting, distillation and neutralization of fatty acids, and continuous saponification of neutral fats, followed by continuous washing and fitting with attendant lye and nigre separation.

Batch Process

This modern soap making process permits fully automatic operation. Saponification, drying, cooling, and vigorous incorporation of all the required additives for a finished soap take place within the confines of the Enrich reaction mixture. The process is applicable to finished soap production from fats and oils, fatty acids, fatty acid methyl esters, and even syndics.

Table 7.1 below describes the information obtained from cited literatures on the advantages and disadvantages of the alternative process technologies:

Table 9:Comparison of the three soap base production processes

Process	Advantages	Disadvantages
Kettle saponification	- effective for the saponification of both neutral and fatty acids - the process is simple and doesn't require higher qualification operation - investment cost is very low	-it is an elaborate process the quality of the soap base production is very low -high steam consumption -is environmentally unfriendly -long processing time -it is almost an obsolete technology
Continuous saponification	- it is a closed continuous process and hence it is easy to carry out - high quality of soap base is obtained - effective for both neutral oils and fatty acids - it is environmentally friendly - simple but high reliable constant composition control	- somewhat higher investment cost - requires somewhat higher qualification
Batch process	- fully automatic operation - the process is applicable to fats & oils, fatty acids, fatty acid methyl esters & syndets - it is environmentally friendly	- higher investment cost - requires high qualification - not widely practiced i.e., it is very new technology

From the above table, it is obvious that the continuous process is more advantageous over the other two as it has less environmental impact and suitable for implementation as it needs less qualification than the batch process.

7.4 Alternative of the proposed project Vs. The no Project Alternative

From a purely physical environmental viewpoint, the "do-nothing" alternative is preferable to project implementation, since it would avoid creation of any of the adverse impacts associated with the project. However, according to the findings of this EIA study, the socio-economic

benefits attainable by implementation of the Soap and Detergent Manufacturing project would outweigh the consequences of environmental damages related to the project. This can be rationalized by the possible avoidance of and/or minimizing the significant adverse impacts through implementation of the appropriate mitigation measures. Thus, the do-nothing option is not a feasible option for the project.

CHAPTER 8: ENVIRONMENTAL MANAGEMENT PLAN

8.1 General

Environmental management is concerned with implementation of the measures necessary to minimize or offset adverse impacts and to enhance beneficial impacts. Unless the mitigation and benefit enhancement measures identified in the EIA are fully implemented, the prime function of EIA, which is to provide a basis for shaping the project so that overall environmental performance is enhanced, cannot be achieved.

In order to be effective, environmental management must be fully integrated with the overall project management effort at all levels, which itself should be aimed at providing a high level of quality control, leading to a project which has been properly designed and constructed and functions efficiently throughout its life. Hence, the overall goal of the Environmental Management Plan (EMP) of Shum Soap and Detergent Manufacturing Project is to minimize adverse impacts of the project by managing and implementing the proposed impact alleviation measures and good working practices.

Under this section specific management activities (at the pre-construction, construction and operation phases) to overcome possible impacts of the project are outlined.

8.2 Pre-Construction Phase

Prior to the construction and installation of the factory, environmental management will be considered with four principal groups:

- Ensuring that all government and concerned agency requirements and procedures related to EIA are complied with
- Selecting of technologies, equipments and process units in a manner that minimizes adverse impacts in and enhancing beneficial impacts.
- Preparation of detail designs for the factory layout, which incorporate specific features aimed at minimizing adverse impacts and enhancing beneficial impacts.
- Preparation of contract documents which contain appropriate clause to allow control of impacts arising from constructing & erecting of the factory

As the project promoter, Shemu Soap Manufacturing plc will be responsible for handling the above issues before the commencement of the construction; the company will hire an environmentalist and engineering consultant that facilitates these activities and inter institutional relationships for the environmental management and other construction activities as well.

The Dire Dawa City Administration Environmental Protection Authority will also be responsible for ensuring that its own environmental requirements are fully met in the EIA study report. Dire Dawa City Administration Trade, Industry and Investment Bureau is other responsible government agency that will be responsible for ensuring procedural consistency of the project for providing an investment license.

8.3 Construction Phase

During constructions and installation of the factory units, the contractor will be responsible for implementing the environmental mitigation measures proposed in this EIA study report. The construction supervisor shall monitor impacts and their proper implementation of mitigation measures. He / she will be fully responsible for ensuring that all the works to be carried out in accordance with the specifications and drawings, that the environmental impacts will be taken into the consideration and that good workmanship be followed. He/she should be empowered to deal with in fragments at the time and on the spot.

It is also proposed that an environmental inspector to be arraigned by the proponent. The major environmental management issues to be undertaken during the construction phase are presented in the following subsections.

8.3.1 Site Preparation Management

As it was described frequently in foreparts of this study, the already established factory and additional requested area, which is going to be used for the expansion of Shemu Soap and Detergent Factory, has leveled land feature, allocated for industrial area and yet only covered with shrubs.

However, the site preparation and other related activities should be done in a manner that the activities do not affect the landscape integrity of the project site as well as avoiding alteration of existing vegetation cover in the area as far as possible. Particular attention will be paid to

managing the site preparation work where by preventive action can be taken by the contractor in the event when there is loss of landscape integrity that can result environmental damages (like soil erosion, unnecessary loss of shrubs, and vegetation covers). The environmental inspector has to ensure the proper management of the activities and liaise with the contractor in a usual base.

8.3.2 Waste Management

All solid and liquid wastes generated from the construction activities should be managed properly. Solid wastes must be collected and burnt in a burn pit specially created for this purpose. These burning pits must be placed away from the groundwater well head and the nearest public faculties and covered up after completion of the construction work.

All the used oil from the plant and equipment must be collected and burned or buried in specially secured landfill effectively sealed from the surroundings. Environmental inspector has to ensure the proper implementation of these activities and submit report on the status of environmental management to the Company concerning local authorities.

8.3.3 Air pollution and dust management

The construction action is the major source of dust emission and air pollution. However, it can be managed by:

- Discarding construction wastes in an appropriate or authorized waste management facilities/land fill sites.
- Preventing the generation of air pollution during the construction period by water sprinkling

8.3.4 Health and risk management

Health and risk management should be done to avoid unnecessary impact on human health. Providing health facility (mobile clinic or first aid service depending on the size of workforce), and committing stand by vehicle to provide transportation service in case of accident are the main element of health and risk management. In addition to above facilities, the contractor should provide proper and standard protection wears like helmets, masks, dust proof breathing martial and shoes.etc., to his/her employees.

8.4 Operation phase

Most of project environmental management activities will be carried out during the operation phase, since this is when long term significant impacts (including environmental pollution and human health hazard) can be expected to arise.

The objectives of the environmental management program at this phase of the project are: protection of the environment from process induced wastes and other pollutants, protection of workers from work area health hazard, efficient use of water sources and furnace fuel, waste management and improve the environmental performance of the company.

Beside the environmental management tasks to be performed by different functional units of the company; the Consultant proposes an environmental and safety officer that works as freelancer to operate the environmental management program at this stage of the project.

The environmental and safety officer will coordinate and monitor all aspects of the environmental management programs; develop further an environmental oversight capability within the company; and facilities for the implementation of companywide Environmental Management System (EMS).

The major environmental management issues to be under taken during this phase of the project are presented below.

8.4.1 Environmental pollution prevention and management

Environmental pollution prevention and management will very largely be concerned with controlling pollution of the environment which may result from the production process, though

implementation of best available pollution prevention and minimization techniques at each stage of the production process as well as at storage and handling chemicals.

8.4.2 Cleaner Production Audit Team

Since the environmental management program serves as a tool to avoid or mitigate potential negative and to enhance potential positive environmental impacts of the project, the consultant prefers the involvement of everyone in the company especially in preventing and minimizing waste at the source of generation. For this the Consultant proposes a cleaner production audit team organized from different departments of the company to operate subordinately with the environmental program of the production phase of the project. The audit team would prominently generate cleaner production options and implement them: to avoid industrial pollution by reducing waste generation at every stage of the production process in order to minimize or eliminate wastes at their source before any potential pollutants. Specific duties of the audit team will include the following:

- Develop a systematic waste and emission reduction audit procedures;
- Identifies sources of wastes and causes for their generation
- Generate possible options to mitigate (i.e. prevent or minimize) generation of wastes
- Evaluate all generated possible options from economic, environmental and technical perspectives and select the feasible option
- Develop a systematic waste reduction plan that contains specific waste reduction goals for the feasible option
- Educate and involve employees at all level in identifying and quantifying the problems and in seeking creative solutions to eliminate or to minimize problems at their source
- Obtain the best management and technical information possible to help the company advantage of efficiency improvement and waste reduction opportunities.
- Review and update efficiency improvement and waste reduction goals and time tables regularly

The number of people the team can comprise depends on the cleaner production technologies levels the company preferred to implement. However it is an obligatory for presence of environmental and safety officer and top management representative in the team. This is because

the environmental and safety officer lead the cleaner production projects whereas the top management representative ensures the top management commitment for the projects.

8.4.3 Work area safety

Particular attention should be given for controlling employee's health from chemicals that can cause acute & chronic health problems. Both technical and administrative aspects should be considered. The environmental and safety officer and the production supervisors will be responsible for managing the technical management aspects. They ensure that procedures for hazard and accident response are ready and well placed. The labor officer will be responsible for administrative management aspects.

8.4.4 Waste Management

An integrated waste management system should be implemented. All solid and liquid wastes generated from the production process should be managed properly. A companywide integrated waste management system to be implemented for this purpose. The system to be applied for each aspect of the issue and it must provide a hierarchical waste management approach for each aspect in which waste prevention to be at the top of this hierarchy. The environmental and safety officer will prepare cost effective and environmentally sound management options for managing every waste concerns at this production phase. The production manager will be responsible for the implementation plans. He/ She will ensure effectiveness of the management system in usual bases. The environmental and safety officer will review the management plan and evaluator the sustainability of the management plans.

8.5 Budgets for the Environmental Management Program

Most of the cost for the environmental management is mainstreamed in the design of the factory infrastructure, choice of production technology and operation practice, and in implementation of emission and effluent control units. Therefore, most of the environmental concerns are addressed in the construction & operation of the project. However, some cost is involved for the environmental management practice. Cost component of the environmental management of the project includes:

- Salary of the environment & safety officer (as freelancer)=48,000 birr/ annum

- Periodic training & awareness program for the employee=25,000 birr/annum
- Environmental monitoring and reporting = 20,000 per annum
- Waste management = 55,000 birr per annum

The total cost for annual environmental management is estimated to be Birr 148,000.00.

CHAPTER 9: ENVIRONMENTAL MONITORING PROGRAM

Monitoring a project or a program and its surrounding is a tool for decision making not an end product. Pertaining to Shemu Soap and Detergent Project the monitoring will involve both quantitative and qualitative data, as appropriate to the nature of the information.

Both due to its significance and comprising different components; the production stage environmental management monitoring and implementation program presented in detail.

9.1 General Consideration

Environmental monitoring is very essential part of the project implementation. It helps to follow up the implementation of the proposed mitigation measures, as they are required and to anticipate possible environmental hazards and/or to detect unpredicted impacts over time. Such monitoring has to be carried out by the different departments of the company as well as by the environmental and safety officer in a regularly bases. The company top management together with affiliated units of the Dire Dawa City Administration Environmental Protection Authority and representatives of Dire Dawa City Administration Trade, Industry and Investment Bureau should have to carry out an occasional monitoring on the performance of the environmental management plan. Random monitoring on selected environmental indicators also important as it is essential for auditing the environmental protection program of the company.

The environmentalist and safety officer together with the production supervisors and Production Engineer is as the central point in monitoring the environmental management plan of the operation phase of the project; the responsibility of this team will be ensuring the implementation of all the proposed mitigation measures. The team should focus on the following main environmental management plan themes:

9.2 Monitoring the Environmental Protection Measures

Monitoring proper functioning of the proposed wastewater treatment plant (if the pollution amount is above the limit specified in the standard) is the main monitoring issue of the project. This include regular measurement of the pH, BOD, TDS, and fats, oils and grease within the effluent of the treatment plant; regular inspection on the proper functioning of the wastewater treatment plant. Laboratory chemist and the waste water treatment plant operator will be

responsible for monitoring the regular measurements, while the production manger and the environmental officer will be responsible for reporting the top management and relevant regulatory body. Random monitoring can be made by Dire Dawa Environmental Protection Authority as well.

Monitoring the functionality of dust collecting devices and instruments is the other monitoring issue of the production process. Production operators, electrical and mechanical equipment technicians will be responsible for regularly monitoring the units. Boiler operator and other technical staffs will be responsible for monitoring the functionality of gas analyzer on the boiler stack. The production supervisors periodically report the level of SO2, CO, NO2 and other contaminant constituents to the environmental officer. The environmentalist and safety officer verify the compliance of the emission level with relevant emission standards and prepare action plans for correction in case of non compliance together with the production manager.

9.3 Monitoring Process Waste Management System

An Integrated waste management system should be implemented. All solid and liquid wastes generated from the production process should be managed properly. A companywide integrated waste management system to be implemented for this purpose. The system to be applied for each aspect of the issue and it must provide a hierarchical waste management approach for each aspect in which waste prevention to be at the top of this hierarchy. The environmental and safety officer will prepare cost effective and environmentally sound management options for managing every waste concerns at this production phase. The production manager will be responsible for the implementation plans. He/She will ensure effectiveness of the management system in usual bases. The environmental and safety officer will review the management plan and evaluator the sustainability of the management plans

9.4 Monitoring of correct use of process chemicals

Excess use of process chemicals increases the contaminant loads in the wastewater effluents. Therefore, the production supervisors have to monitor the correct use of process chemicals as per the stated concentration and application rate on the processing recipe. In addition to this the unit should check dosing and weighting instruments to be used. Beside these monitoring activities,

the company should implement a management system that monitor product quality and provide a means for dealing with product quality incompliance.

9.5 Monitoring of Groundwater Resource

The project will have significant impact on both the quality and quantity of the existing ground water resources in the area. Therefore, the environmental and safety officer and the production manager has to monitor any impact of the project on the existing wells water table and the quality of the water from the well to be developed by the factory. Additionally, the unit should establish systems to monitor the impact of future developments on the water table.

9.6 Monitoring Employees' Health Hazard Protection Measures

Health situation of those workers having potential contact with toxic and hazardous chemicals has to be monitored to see the impact of the chemicals on the human health and also it has to be checked whether the proposed mitigation measures to overcome the health impact are carried effectively or not. The labor officer has to inspect and ensure the implementation and effectiveness of employees' health hazard protection measures. In addition to this, the environmental and safety officer and the production manager have to inspect the overall environment of the work area situation in relation to workers' health.

9.7 Monitoring the performance of the environmental management plan

The aim monitoring the EMP is to determine the adequacy of the past and present tasks, so as to plan for the future. The evaluations will address the subjects of staff, progress of working activities and changes to work plans. The environmentalist and safety officer will present the evaluation report for the company's top management in monthly bases.

CHAPTER 10: CONCLUSION AND RECOMMENDATIONS

The implementation of the proposed Soap and Detergent Manufacturing project will have a pack of economical and social benefits. It plays a role on the country's economic development activity through creates an employment opportunities for citizens, generates income for the local community, and it also paves the way for rural development in the area. On the other hand, if improper utilization of effective process settings is there, the proposed project has some associated environmental aspects that might cause adverse impacts. However most of these environmental effects can be reduced to acceptable levels with good engineering practices; implementation of pollution prevention and control techniques, and integration of restoration and other mitigation measures proposed in this EIA report. Therefore, it can be concluded that there will be no severe or immitigable impacts that will prevent the implementation of the proposed industrial development project. To have minimal and acceptable residual environmental impacts, it is recommended that the proposed mitigation measures should be properly implemented. A close follow up of the effectiveness of the implemented measures is recommended since a well-planned monitoring program is critically important.

In general, the Consultant perceived that there are no insurmountable environmental difficulties for the implementation of the proposed Shemu Soap and Detergent Manufacturing Project.

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