DEPARTMENT OF BUSINESS ADMINISTRATION

ASSESSMENT OF WASTE MANAGEMENT PRACTICES AND CHALLENGES: A CASE OF NATIONAL ALCOHOL AND LIQUIR FACTORTYADDIS ABABA

BY

SAHLE HALEFOM ID NO. /0188/2012A
SECTION --2012 B_B

A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIIES OF ST.MARRY UNIVERSITIN PARTIAL FULFILLMENT OF THE REQUIRMENT FORTHE DEGREE OF M.A IN BUSINESS ADMINISTRATION.

(MARU SHETE (PH.D)

DECEMBER, 2021
ADDIS ABABA ETHIOPIA

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Approved by Board of Examiners

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External Examiner	Signature	Date

ENDORSEMENT

This thesis has been submitted to St. Mary's University College, School of Graduate Studies for examination with my approval as a university advisor.

_____ _____

Advisor Signature& Date

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STATEMENT OF DECLARATION

I, SahleHalefom have carried out independently a research work on waste management practice and challenges (a case of national alcohol and liquor factory Addis Ababa) in partial fulfillment of the requirement of the MBA program for the degree of MA in business administration. This study is my own work that has not been submitted for any degree or diploma program in this or any other institution.

Sahle Halefom

December,2021

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ABSTRACT

Wastes generated from alcohol factories, being highly polluting industrial wastes, should be managed in an environmentally safe way. But a report in Ethiopian alcohol industry shows that the wastes generated from the alcohol industries located in Addis Ababa city are collected, transported and disposed along with municipal solid wastes in open dumping area called"Koshe" or "Rapi". This study aims to assess the waste management practice and challenges of NALF and evaluate existing waste management practices. The researcher used descriptive research approach in order to assist the decision maker in determining, evaluating, and selecting the best course of action to take in a given situation. This study used a mixed method approach using both qualitative and quantitative methods to adequately answer the proposed research questions. The study used simple random sampling to select 143 out of the 222 staff. The researcher used both primary and secondary sources of data. Structured questionnaire and interview question were given to respondents. Primary data were collected using a structured questionnaire & interview. Secondary data were also collected from books, Journals, magazines, and newspapers, websites, and documents from the concerned departments. Data processed via SPSS version 20 and presented in tables and percentages. Therefore, in order to determine the most appropriate waste management strategies, it is highly important to acquire the information concerning the process steps, from which these wastes are generated, the target product desired to be produced through these processes, and the characteristics of the wastes. NALF implementing different systems and mechanisms that would help to reduce, reuse, recover, recycle, treat and properly dispose. One of the actions observed in the dump site during data collection was that there are excellent projects to change waste to feed animals and fertilizers wastes and effluent plant treatment that the researcher would like to recommend.

Key Words: - Waste, Waste management and Alcohol industry

ACROYNMS

AGEP	Addis Ababa City Government Environmental Protection Authority
BOD	Biological Oxygen Demand
COD	Chemical Oxygen Demand
DS	Dark Silage
DAP	Di-Ammonium phosphates
NALF	National Alcohol and Liquor Factory
OM	Operational Management
RGA	Responsible Government Authority
UNEP	United Nation Environmental Program
UNIDO	United Nation Industrial Development Organization
WH	white Silage
WM	Waste management

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CHAPTER ONE

1. Introduction

1.1 Background of the Study

The rapid growth of industries has led to a dramatic increase waste generation with environmental and public health problems associated with water contamination, emission of toxic and noxious fumes, soil contamination and introduction of disease vector populations. The management of waste is one of the challenges facing any industry in the world. Industries are the major source of environmental pollution, both globally and locally. Over the past decades, world industrialization has responded to environmental pollution in the following sequenced ways (UNIDO, 2002).

Industrial wastes are wastes considered as useless occurring during a production process and exist in solid, liquid and gaseous states. Humans pollute their environment with these industrial wastes (Mekonnen, 2012).Industrialization is the back bone for development as it contributes for economic growth and human welfare. However, the ever-increasing industrial activities lead to environmental pollution and ecosystem deterioration globally. Especially, untreated and partially treated industrial wastes are the major threats for water ecosystems (Firdissa et al., 2016). In Ethiopia, the rapid industrialization has led to the generation of industrial wastes including the hazardous ones (Teku, 2006). Improper management of vast amount of industrial wastes is one of the most critical environmental problems in Ethiopia, especially, in Addis Ababa (Firdissa et al., 2016).

Waste management is a current, complex subject. Almost all human activities create waste; especially since the Industrial revolution in the mid-18th century, the amount of waste created increased dramatically around the world. Not only has it increased in amount but also in type and toxicity. Waste management is an issue to most countries around the world. The waste management in a given country is directly related to the economic, social and political status of the country (Ozgunay et al., 2017).

waste management is defined as the discipline associated with control of generation, storage, collection, transport or transfer, processing and disposal of waste materials in a way that best addresses the range of public health, conservation, economic, aesthetic, engineering, and other environmental

considerations.They also pose a wide variety of administrative, economic, and social problems that must be managed and solved (Kolomaznik et al., 20015).

Cleaner production (Pollution Prevention) is called a "win-win" strategy, because it protects the producers, the environment, and the consumer at the same time improving industrial efficiency, profitability and competitiveness of company. Cleaner production should not be considered simply as an environmental strategy; because it does not deny economic and industrial growth, but it makes growth to be environmental friendly. Some industries in the world implement and develop efficient material utilization technologies and management strategies to reduce their resource consumption per unit of product. However, developing countries like Ethiopia are lagging behind such efficient technologies (Alebachew, 2011).

Alcohol production process use raw materials like sugar, starches and cellulose. One of the most widely used raw material for alcohol (ethanol) production is molasses which is the by-product of sugar factories. Ethanol production factory use huge amount of water, energy, molasses and various types of chemicals, which could generate a large amount of wastes during inefficient material utilization. Thereby, molasses based alcohol industries are grouped under chemical industries which produce numerous environmental pollutants during less material utilization. The biochemical oxygen demand (BOD) and chemical oxygen demand (COD) of molasses based distillery typically range between 35,000-50,000 and 100,000-150,000 mg/liter respectively (Patel, 2018). Factory considered as an environmental hazard when there is high BOD and COD in the waste during alcohol production (Patel, 2018). Thus, factories should increase their resource utilization efficiency and in waste treatment plant.

In recent years, Ethiopia has become a regional leader in waste management. The country transformed the Koshe dump site, the only landfill in Addis Ababa, into a new waste-to-energy plant, the first such project on the continent. The plant incinerates up to 1,400 tons of waste every day roughly 80 per cent of the city's rubbish supplying the capital with 25 per cent of its household electricity needs (IsayasTadesse, 2013).

Although the country has ratified the Basel, Stockholm and Rotterdam conventions, legislation and policies for environmentally sound management of hazardous chemicals and wastes are still at a very early stage and not effective in preventing illegal dumping of waste as well as contamination of water, soil and air resources (IsayasTadesse, 2013).

To help Ethiopia meet these challenges, the Chemicals and Waste Management Program is supporting the country with a project to enhance institutional capacity for sound management of hazardous wastes and persistent organic pollutants (UNIDO, 2000).

National Alcohol and liquor Factory (NALF) is the former government that the producer of pure Alcohol and liquor in the country. The factory comprises four branches which were once established and owned by sole properties in different periods. The branches are named as Sebeta Branch, established in 1898 E.C, Head office or Mekanisa Branch Factory established in 1949 E.C, Maichew branch established in 1906 E.C and Akaki branch established in 1930 E.C which is not functional now **(**NALF documents and manuals, 2013).

In 1976 G.C the Ethiopian Government nationalized and owned the above mentioned factories under umbrella of National Alcohol and Liquor factory. Since then, the factory attempt to produce and distribute pure Alcohol and various types of liquor products throughout the country. Now it is the biggest alcohol producer of NALF which is 40,000 liters per day. Indeed, for the increased alcohol production, at the same time wastes are increased (NALF documents and manuals, 2013).

The present National alcohol and liquor factory have grown to the highest quality and taste of its variety products. If properly managed, now a day waste can be a resource of one organization. Therefore to stay competitive in market the top management and middle management of NALF should commit to implement waste management practice and addressing solutions for the challenges of waste management.**(**NALF documents and manuals,2013).

1.2. Statement of the Problem

Eradication of waste has been a daunting challenge in the beverage industry. Beverage industries are faced with many problems. One unique problem is that of a short shelf life relative to other manufacturers when production is excessive. Although, a lot of strategies have been put in place to minimize waste but these have failed to meet the set standard of the waste regulatory bodies. The beverage industry specializes in the continuous production of drinks for human consumption. Production can be unbearably tasking because of the incessant daily demands. The drinks either come in bottles or cans. This is a function of the initial design of the production line. The cans and bottles could also come in the form of plastic or glass. The containers could be cold filled; hot filled; conventional or natural. A lot of factors are put in place in the production of containers because of the inherent characteristics of the liquid content. By request, some beverages are catalyzed alcoholic while some are not. The Alcohol and sodas produced in the twentieth century were known for high acidity and somewhat higher enclosure pressure. They were made available in cans due to the interior liner technology that was able to preserve the flavor from being contaminated via chemical reactions with the metal can. Those interior liners were either plastic or waxy substances that have the ability to remain intact for a long period of time without reacting or adulterating the liquid content of the can over a period of time. The level of adulteration varies for different non-alcoholic and alcoholic beverages. Before the twentieth century, beverages were made available in glasses or barrels. The use of can from the twentieth century was borne out of the desire for lighter weight material. The awareness of waste reduction in beverage industries has led to many of the improvements demonstrated in the sector. A lot of waste reduction techniques have been put in place to ensure effective optimization of beverage packaging. This was achieved by incorporating a series of waste reduction criteria subjected to extensive and open dialogue between producers and consumers. The numerous waste reduction strategies it has been difficult to completely overcome waste that result from the metallic taste of the interior liner of can beverages. This is common with beverages that contain a lot of acidic sodas (Abel Afon, 2007).

Elimination of waste minimizes running cost and optimize profit margin. Waste auditing is one of the waste management tools that have been employed to minimize waste. This is simple appraisal of the nature and quantities of waste that is being generated in the beverage industries and has helped to decide the collections of materials or containers required for beverage production. It also identifies materials that can be recycled. Since all beverage industries are not the same, the quantity of waste and recyclables vari es. Industries includes: Raw Material Wastes, Packaging on incoming beverages and wastes during filtration process which contribute to the water waste and liquid treatment sledges. The beverage

industries have been responsible for the on-site generated waste and putting together of the out-going products that end up as waste. Reduction of waste can be highly beneficial to the beverage industries. This will influence all aspect of production and an eco-friendly atmosphere for continuous production that is void of regulatory agencies uneasiness. Waste reduction in beverage industries reduces materials purchase cost; it enhances the employee and employer satisfaction by creating a working environment which arises from effective management of waste. Waste reduction also reduces the environmental impact of waste and destruction of resources and minimizes the cost of waste disposal or destruction. The budget for waste destruction can be channeled towards the funding of other sectors of the business. Considerations for waste management improvement and waste hierarchy in beverage industries .The implementation and improvement of waste management often require foremost planning and change in the operation mode of the industry. This may involve training the employee and creating awareness on the use of new and existing equipment as to achieve minimal waste. More so, reduced wastage is more likely to be achieved when there is a set target on the part of the management on the minimum required waste in every production. This can be achieved by setting their priorities right in the need of raw materials (AbejeHiruy,2009).Generally, avoidance of waste delivers satisfactory financial and environmental dividend which can be made a culture having the right management on board .

The waste hierarchy presents a structure for controlling waste in the beverage industry. This also enables the delivery of maximum profit all year round. The waste hierarchy is:

- Avoidance of waste
- Reduction of waste
- Reuse of waste
- Recycling of waste
- Disposal and Destruction of waste

Some vital waste and production control tools have been put in place in beverage and other manufacturing industries Series of lean manufacturing tools have been used as production control and waste identification tools in food and beverage industries. These are wastes due to production beyond demands, wrong processing, over inventory and wastes that result from defective raw materials. It is expedient for a socially responsible organization to adopt continuous waste elimination strategies instead of the regular reduction approach (AbejeHiruy,2009).Researcher (AbejeHiruy,2009)tried to show the present details of Alcohol industries waste management practice, particularly about BOD,COD that are characteristics ,parameters in waste water treatment(liquid waste) that are relevant to the topic ,in addition about liquid waste. But, he couldn't recommend solid waste management practices relevant for

Ethiopia which are found at infant stage; rather he recommended sophisticated method that needs high capital, technology, skill man power that may be relevant for developed countries like USA and Germany. The researcher didn't say anything about recovery strategy and environment as well, and how much goes in and out of factory, how much is recycled there? What is produced? How much is produced? Who buys these materials? And how do the factories recycle the materials they buy? All this crucial information is missing. Especially, not knowing how the solid wastes are recycled in the factories is quite dangerous to the factory. Since the method of residue disposal and amount of emission of the recycling process is not known, it can be very harmful to the environment. The quantity of the solid waste products on the market will also increase if the process is not done properly. If these solid wastes are increased they will also be carcinogenic to the human health. He didn't say anything about Addis Ababa rivers pollution that costs the country about ten billion birr investment these times. Another researcher called (cristina-piera, 2018) tried to explain about waste management but the methodology is far from the objective of the paper. As a result the researcher will try to fill the above gaps especially the challenges of waste management, impacts of wastes on the environment, human beings and plants of NALF.

1.3 .Research questions

1. What are the major types and sources of wastes at NALF?
2. What is the level of existing waste management practice at NALF?
3. What are the existing solid wastes management challenges at NALF?

1.4. Objective

1.4.1. General Objective

This study was aimed to assess the existing waste management practices and examine the waste management challenges of NALF.

1.4.2 Specific Objectives

The specific objectives include:

1. To assess the major sources of waste of NALF.
2. To evaluate the existing wastes management practice at in NALF.
3. To assess the existing wastes management challenges at NALF.

1.5. Significance of the Study

Waste quantity and composition data are necessary to assure that needs are met and that management options available match these needs. From this point of view, the findings of this study would give great importance in gathering useful, accurate, and appropriate data on the amount and nature of NALF manufacturing processes during operation from input to finished alcohol and liquor and propose a waste management practice for the sludge, a hazardous waste.

1.6. Scope of the Study

The scope of the study is delimited only to waste management practices and challenges at NALF. Besides the fact that the scope of waste management practices and challenges at NALF is very high and complex it would be impossible to cover all areas of the discipline and put much effort on only waste management practices and challenges at NALF. This study analyses the actual processes performed in NALF in order to propose better waste management practices. Due to the limited scope of the research study, only waste management practices and challenges would be discussed in detail, waste generated during alcoholic manufacturing operation from raw malt input to alcohol and liquor. This study analyses the actual processes performed in NALF in order to propose better waste management practices.

1.7. Limitation of the study

One research work cannot be found without problems. Some limitations of this study work would be lack of information, lack of resource, internet access, references, lack of experiences and lack of consistent data since it is new phenomenon, lack of enough documents. In addition to the above restrictions, some of the officials of the NALF are not willing to provide certain relevant information's by assuming that information requested is very confidential, even if it is not.

1.8. Organization of the study

This research consisted five chapters. Chapter one provides the research background, research objectives, significance of the study, scope, and the limitations encountered in the course of the Study. Chapter two reviews related literature on the subject matter. More specifically, the chapter reviews theoretical & empirical literature and present the conceptual frame work of the study. Chapter three deals with the meth odology employed in the study. The study findings and their interpretation are presented in chapter four. Chapter five includes conclusions and recommendation of the study and the policy implications.

1.9. Definition of Key words

According to Davies (2008:4, cited by Baabereyir, 2009) waste is ―unwanted or unusable materials that emanate from numerous sources from industry and agriculture as well as businesses, institutions and households and can be liquid, solid or gaseous in nature, and hazardous or non-hazardous depending on its location and concentration.Davies further notes that what might be considered waste to some people can be a source of value to others. Inherent in Davies definition is a classification of waste. The table below therefore shows the classes of waste.

waste management is defined as the discipline associated with control of generation, storage, collection, transport or transfer, processing and disposal of waste materials in a way that best addresses the range of public health, conservation, economic, aesthetic, engineering, and other environmental considerations. They also pose a wide variety of administrative, economic, and social problems that must be managed and solved (Kolomaznik et al., 20015).

CHAPTER TWO

2. Literature Review

2.1. General condition of wastes

Market failures exist in the economic markets all around us and these prevent economic agents from making optimal choices, ultimately leading to an over-production of waste; environmental externalities are one of the primary market failures – whereas economic decisions do not account for the environmental impacts of waste generated (Defra, 2011a).

2.2. Basic Concepts and terminologies

2.2.1. Waste

Waste is any byproduct that results from consumer-based lifestyles (Hoornweg and Bhada-Tata, 2012).

2.2.2. Waste Management

Waste management is the collection, transport, processing, recycling or disposal, managing and monitoring of waste materials**.** The term usually relates to materials produced by human activity, and is generally undertaken to reduce their effect on health, the environment or aesthetics. Waste management is also carried out to recover resources from it. Waste management can involve solid, liquid gaseous or radioactive substances, with different methods and field's expertise for each. Waste management practices differ for developed and developing nations, for urban and rural areas, and residential and industrial producers. Management for non-hazardous waste residential and institutional waste in metropolitan areas is usually the responsibility of local government authorities, while management for non-hazardous commercial and industrial waste is usually the responsibility of the generators (Defra, 2011b).

2.3. Waste management practice of NALF

2.3.1. Solid waste management of NALF

Solid waste of the factory was identified, segregated, collected and transported to appropriate area by concerned process owners and disposed can be handled by facility management according to solid waste

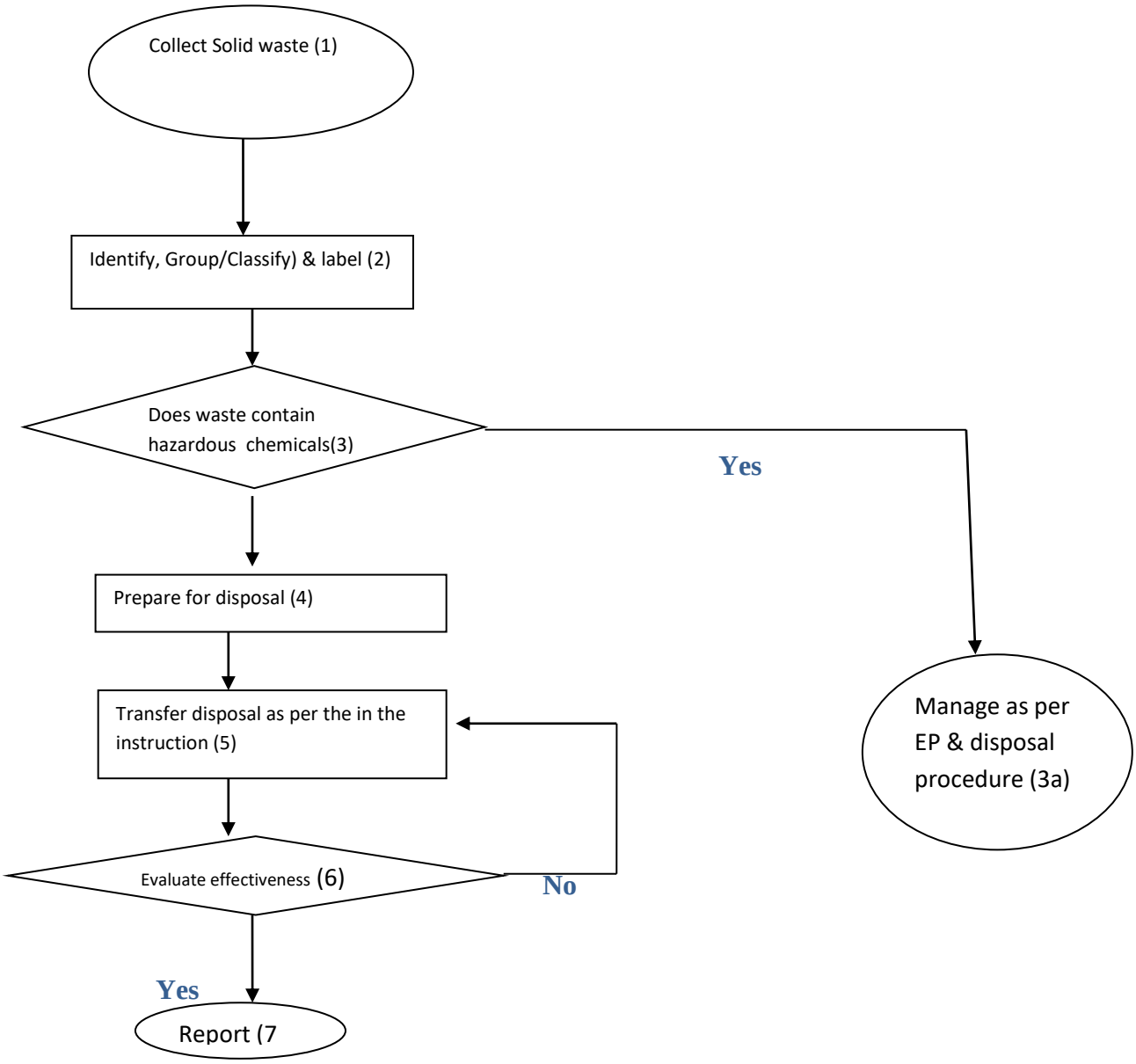
management procedure and communicate with concerned body who disposes the solid wastes. Those wastes that have no further use to the company is done by micro and small enterprises having formal agreement to collect from the company and dump them in designated containers to Reppi or Kosho open dumping site for all solid wastes. Wastes like molasses concentrates has disposed to the land field which is selected place by the responsibility authority called Addis-Ababa mezegaja through the organization vehicle. The other solid waste of NALF called broken bottles has disposed through sold them to Addis-Ababa Birchiqo Company for recycling process **(**Observation and NALF documents and manuals, 2013)

Facility management Department of NALF has the overall responsibility for evaluating, implementing, monitoring assessment of the solid waste management; routine inspection of the solid waste storage area; to keep storage area tidy and free trash; responsible for preparing a schedule for disposing solid wastes, insure segregations of nonhazardous waste from hazardous material or waste and follow up the disposal of no recyclable material by the RGA **(**Observation and NALF documents and manuals, 2013)

Property Administrative Department of NALF has the responsibility for waste minimization by sorting and handling of raw materials in a proper way and regular inspection of raw materials in from damage.

Production Department of NALF is responsible for collecting all solid waste generated from lines during production and trains the operators for handling and sorting of the general wastes.

Personnel Department is responsible follow up the correct the procedures according the waste management standard of the organization and determining the type of waste they need to dispose of and following the procedure to ensure it is disposed of properly **(**Observation and NALF documents and manuals, 2013)



Solid waste handling procedure of NALF

Figure 2.1

2.3.2. Liquid waste Management

The Liquid waste of the factory has controlled by operators which monitors and controls the operation of liquid waste treatment plant continuously for 24 hours. And, the quality assurance team monitors and follow up the waste treatment process and frequently conduct laboratory analysis to assure the final discharges to water within environmental protection agency limit. Generally to prevent environmental pollution of the factory responsible and authorized person were assigned and continual manage the wastes generated day to day activities. (Observation and NALF documents and manuals 2013)

2.4. Functional Elements of solid waste management of NALF

NALF used different type of solid waste management systems in order to properly practice and manage wastes,Observation and NALF documents and manuals 2013)

Figure 1.2 Solid waste of NALF

2.4.1. Waste generation

NALF used waste generation system for materials are identified as no longer being of value and are either thrown away or gathered together for disposal.**(**Observation and NALF documents and manuals 2013**)**

2.4.2. On-site handling, storage, and processing

NALF used Activities associated with the handling, storage, and processing of solid wastes at or near the point of generation through using and distributes baskets for each office to collect different type wastes.**(**Observation and NALF documents and manuals 20213)

2.4.3. Collection

NALF used activities association with the gathering of solid wastes and the hauling of wastes to the location where the collection vehicle is emptied.**(**Observation and NALF documents and manuals 20213)

2.4.4. Transfer and transport

NALF transfer of wastes from the smaller collection vehicle to the larger transport equipment and the subsequent transport of the wastes, usually over long distance, to the disposal site.**(**Observation and NALF documents and manuals 20213)

2.4.5. Processing and recovery

NALF applies equipment and facilities used both to improve the efficiency of the other functional elements and to recover useable materials.**(**Observation and NALF documents and manuals 20213)

2.4.6. Disposal

NALF implemented activities associated with ultimate disposal of solid wastes Interrelationship of functional elements comprising a solid waste management system. The common solid waste disposal methods applied on NALF are

a. **Composting** is one of the means of waste minimization. The mechanism implies a biological waste treatment process. The action of microorganisms breaks down complex organic compounds into simpler ones. Composting is not final disposal method but converting waste into a useful product. Compost has been used in both the rural and semi urban areas of Ethiopia for quite a long time as a soil conditioner to grow mostly vegetables and crops but without processing it.
b. **Controlled Typing (Burying)** Solid wastes that are not recycled or used should be disposed. Disposal is effected in many different ways. But the most important method is that which is able to isolate the waste for good. A method that satisfies this is known as controlled tipping. It is a way of isolating any type of waste without bothering to sort or separate. Controlled tipping is a simple, effective and relatively cheaper method of refuse disposal.
c. **Incineration** is a high temperature dry oxidation process that reduces organic and combustible waste to inorganic, incombustible matter and resulting in a very significant reduction of waste volume and weight.

Ploughing in fields is applying waste in farm fields for soil conditioning has been practiced in Ethiopia for a long time. This is a practice with a dual purpose; it is one hand a way of waste disposal and on the other hand a means of recovering and reusing waste for soil conditioning.**(**Observation and NALF documents and manuals 2013)

2.5. Challenges of Waste Management

Waste is a critical environmental challenge in a number of beverage industries. However, illegal dumping of solid waste is reported to be affecting sewer systems due to blockages, especially from plastic objects which are not biodegradable. Chifamba (2007) observes that accumulation of copper (Cu), lead (Pb), and zinc (Zn) is found within waste disposal sites. Mismanagement of solid wastes not only pollutes the land but also contaminates surface and underground water.The existing laws on waste management are not being effectively enforced (Liyala 2011; Oberlin2011; Okot-Okumu&Nyenje 2011; Simon 2007), which may be attributed to inherent weaknesses of the laws themselves. The informal sector and the community therefore operate with little or no regulation at all.The main problems of the composting project are sorting which is not done at source but on delivery of wastes, mixed wastes of all categories increasing health risk to workers and lack of market for the compost. Some authors (Matete&Trois, 2008; Mbeng*et al.,* 2009; Mbuligwe&Kasenga, 2004; Rotich*et al.,* 2006; Wang *et al.,* 2008) have identified recycling, composting and biogas production as feasible options with social, economic and environmental benefits by reducing amounts of waste disposed, saving the environment and generating income for communities the lack of municipal integration and support leaves composting, which is technically viable, to be strongly vulnerable to external factors (Oberlin &Sza´nto´, 2011). In such industries found in Ethiopia these innovative methods for waste management remain un-researched denying interested individuals among the top management of the organization information on such projects.There are also the negative factors of attitude and culture that have prevented in some cases the very important element of public participation as noted by some authors (Kaseva&Mbuligwe 2005; Palczynski 2002; Rotich*et al.*, 2006; Yhedgo 1995). The low standard of salary (poor pay), education (high illiteracy levels) and the economy are influencing factors that cause low levels of willingness to participate in such management matters.

2.6. Solid and Liquid Waste Management

Actually, sewage can contain so many different substances, both suspended and dissolved, that it is impractical to attempt to identify each specific substances or microorganism. The total amount of organic materials is related to the strength of the sewage. This is measured by the biological oxygen demand, or BOD and the total amount of suspended solids, or TSS. On the average, untreated domestic sanitary sewage has a BOD of about 200 mg/L and a TSS of about 240 mg/L. Industrial wastewater may have BOD and TSS values much higher than those for sanitary sewage; its composition is source dependent. Another group of impurities that is typically of major significance in wastewater is the plant nutrients. Specifically, these are compounds of nitrogen, N, and phosphorus, P. On the average, raw sanitary

sewage contains about 35 mg/L of and 10 mg/L of P.Finally, the amount of pathogens in the wastewater is expected to be proportional to the concentration of fecal coli form bacteria. The coli form concentration in raw sanitary sewage is roughly 1 billion per liter (Chattaha and Shaukat, 2000; IPPC, 2003).

2.7. Classifications of liquid waste/sewage

Waste water or sewage that are generated from a home or community including toilet, bath, laundry, lavatory, and kitchen- sink wastes, and surface run off may be classified into four. These are:

- Sanitary sewage
- Industrial sewage
- Storm sewage or Mixed sewage (a mixture of all) (Janka 2007)

2.8. Wastewater/sewage composition

Sanitary or domestic wastewater comprises about 99.9%water and only about 0.1% impurities. In other words, if a liter sample of wastewater is allowed to evaporate, only about1gram of solids will remain behind.(Janka 2007)

Standards for the treatment of waste water or effluent prior to discharge have been set. These consist of general and special standards and set limits for aspects such as pH, temperature, chemical oxygen demand (COD), suspended solids, metals etc. The test method that isto be used to determine these levels are also specified. Any industries, or municipal or private wastewater treatment works discharging to river or sea must comply with these limits. In turn, the entity operating a wastewater treatment works must set limits for industries discharging to the works such that the final discharge limits can be met (Sereeram, 2003).

2.9. Public health importance of wastewater/sewage

The improper disposal of waste water play a role in the contamination of surface water, ground water, and the soil Solid and Liquid Waste Management there by posing health problems. These phenomena persist in developing countries and affect almost every one. In Ethiopia, today; all wastes even in large international cities like Addis Ababa are drained to the side of roads to ultimately join small streams or rivers to flow downstream causing water pollution. All the wastes drained in water ways depends on the winter rains for cleaning. Although very high wastewater pollution may not be expected in the rural

Ethiopia, there are some household sewage (liquid dung, domestic wastewater, etc.) generated from kitchens, toilets, barns, and other domestic areas. If household, industrial, or commercial wastes are not properly disposed, then the disease problems caused by pollution will still remain to be persistent in the environment. The disease commonly transmitted through water such, as Cholera, dysentery and typhoid are waste related. If waste was safely deposited, or treated and disposed most of the water borne diseases would have not been a problem (Rail, 2009).

2.10. Points to be consider before selecting one particular sewage disposal technique

There is no single individual sewage disposal technique that can be universally applied under all conditions. However, the selection of a particular method will depend upon the following major factors: The nature of soil formation and stability of the locality. The availability of adequate land for sewage disposal (AbejeHiruy,2009).

The quantity of sewage to be disposed of

- The degree of sewage treatment to be achieved
- The presence of well water, and whether it is used asthe source of the water supply
- The level of the water table of the ground water
- The proximity of the disposal site to surface watersources
- The relative cost of the disposal technology

2.11. Wastewater treatment system.

- Screening
- Grit removal
- Sedimentation
- Secondary treatment
- Tertiary treatment
- Disinfections
- Screenings/grit disposal
- Sludge treatment
- Sludge disposal

Proper handling of contaminated waste minimizes the spread of infection to healthcare personnel and to the local community. Whenever possible, contaminated waste should be collected and transported to disposal sites in leak proof, covered waste containers. (AbejeHiruy,2009).

When possible, use separate containers for combustible and noncombustible wastes prior to disposal. This step prevents workers from having to handle and separatewastes by hand later.

Combustible (burnable) wastes include paper, cardboard and contaminated wastes such as used dressings and gauze (AbejeHiruy, 2009)

Noncombustible (no burnable) wastes include glass and metals. Use personal protective equipment (PPE) when handling wastes (e.g., heavy-duty utility gloves and closed protective Shoes). Wash hands or use a waterless, alcohol-based antiseptic hand rub after removing gloves when handling wastes. It is important to train all community health workers and healthcare workers, including physicians, to keep contaminated and non-contaminated waste separate. For example, throwing a hypodermic needle into a wastebasket in patient's room automatically makes that container hazardous for housekeeping staff to handle. And, if discovered, that wastebasket now needs to be handled and disposed of as contaminated waste (Fathima et al., 2011)

The administration of non-hazardous waste in metropolitan areas is the job of local government authorities. On the other hand, the management of hazardous waste materials is typically the responsibility of those who generate it, as subject to local, national and even international authorities (Raili, 2009).waste is the useless, unwanted and discarded material resulting from day to day activities in the community. Waste management may be defined as the discipline associated with the control of generation, storage, collection, transfer, processing and disposal of waste. Waste can be categorized based on material, such as plastic, paper, glass, metal, and organic waste. Categorization may be based on hazard potential, including radioactive, flammable, infectious, toxic, or non-toxic wastes (Jana 2007).

2.12. The Functional Elements of Solid Waste

2.12.1. Transfer and transport

This element involves two main steps. First, the waste is transferred from a smaller collection vehicle to larger transport equipment. The waste is then transported, usually over long distances, to a processing or disposal site (Ozgunay et al., 2017).

2.12.2. Disposal

Today, the disposal of wastes by land filling or land spreading is the ultimate fate of all solid wastes, whether they are residential wastes collected and transported directly to a landfill site, residual materials from material recovery facilities, residue from the combustion of solid waste, compost, or other substances from various solid waste processing facilities(Ozgunay et al., 2017).

2.12.3. Energy generation

Municipal solid waste can be used to generate energy. Several technologies have been developed that make the processing for energy generation cleaner and more economical than ever before, including landfill gas capture, combustion, pyrolysis, gasification(Ozgunay et al., 2017).

2.12.4 Reduce

Waste minimization is the process and the policy of reducing the amount of waste produced by a person or a society. Waste minimization usually requires knowledge of the production process, (now cradle-to-cradle) analysis .The tracking of materials from their extraction to their return to earth (start a new cycle) and detailed knowledge of the composition of the waste. In industries, using more efficient manufacturing processes and better materials would generally reduce the production of waste (Ozgunay et al., 2017).

2.12.5. Reuse

To reuse is to use an item more than once. This includes conventional reuse where the item is used again for the same function and new-life reuse where it is used for a different function. In broader economic terms, reuse offers quality products to people and organizations with limited means, while generating jobs and business activity that contribute to the economy. Current environmental awareness is gradually changing attitudes and regulations, such as the new packaging regulations, are gradually beginning to reverse the situation(Ozgunay et al., 2017).

2.12.6. Recycling

Recycling is the breaking down of the used item into raw materials which are used to make new items. Recycling of materials and substances contained in solid waste is very simple in theory but extremely hard in practice. People have always collected utilizable and valuable materials from waste and used

them in industry because it is cheaper than extracting them from raw materials. Recycling is the breaking down of the used item into raw materials which are used to make new items (Ozgunay et al., 2017).

2.12.7. Solid Waste Treatment

The remaining final solid waste is disposed in landfills after necessary treatment to lessen the adverse environmental impacts. The objective of treatment is to improve physical and/or chemical characteristics of waste, reduce toxicity and reduce its final volume (Misra et al., 2005)

Energy Pinch technology aids to facilitate recycling of heat (energy) between processes. Heat exchangers allow numerous process streams to come in contact with one another to facilitate heating of cold streams and the cooling of hot streams. The practice is utilized in wart boiling, cooling, pasteurization and bottle cleaning processes(Ozgunay et al., 2017).

The solid waste consists of raw materials used during the brewing procedure, filtering aids and containers used for packaging the beer. Solid waste management and typical solid wastes from breweries include: spent grains, trub, spent yeast, diatomaceous earth slurry from filtration, and packing materials. Most of the breweries feed sheep farms with their spent grains. The amount of waste generated can be broken down into two groups(Fathima et al., 2011)

Fig. 1: Shows Waste Management Hierarchy [3]

Figure 2.2 Waste management Hierarchy(Fathimaet al.2011).

Glass Bottle Facts

- Glass bottles have gotten 50% lighter in weight between 1970 and 2000.
- Glass bottles are 100% recyclable and can be recycled endlessly without loss of quality.

- In 2010, over 41% of beer and soft drink bottles were recovered for recycling, a higher percentage than liquor and jars. In total, 33.4% of all glass containers were recycled.
- An estimated 80% of recovered glass containers are made into new glass bottles, and it can happen quickly. A glass container can go from a recycling bin to a store shelf in as little as 30 days.
- States with container deposit legislation have an average glass container recycling rate of over63%.
- Recycling just one glass bottle saves enough energy to light a 100-watt light bulb for four hours, power a computer for 30 minutes, or a television for 20 minutes.
- There are 48 glass manufacturing plants operating in 22 states, and approximately 76recycled glass (cullet) processors in 31 states.
- Ceramics, porcelain, Pyrex, and dishware are the most destructive contaminants for glass recycling. Make sure they don't get mixed in with your recycled glass bottles. Source: U.S. EPA, Container Recycling Institute, as name suggests, aerobic composting means bacterial conversion of organics in presence of air. It yields compost as final product which is extensively used as fertilizer. Final product is free from odor and pathogens (Ahsan, 1999; Khan, 1994).

2.13. Incineration

Incineration is combustion process which simply means drying and burning of waste. The final product of the process is CO2, H2O in vapor form and ash with a large amount of heat. It is generally preferred for treatment of waste having less moisture content like paper, cloth, pyrolysis(DerejeTadesse, 2001).

2.14. Landfills

In many developing countries, waste is disposed in an open area without any precautions. In most cities, waste is thrown outskirts of the city area without any prior treatment which leads to environmental deterioration. Open dumping of solid waste leads percolation of leach ate to underground water and gas emissions resulting into excessive air pollution. It also disturbs aesthetic surrounding by its odorous environment (DerejeTadesse, 2001).

2.15. Waste Exchanges–

This is where the waste product of one process becomes the raw material for a second process. Waste exchanges represent another way of reducing waste disposal volumes for waste that cannot be eliminated

due to extreme limitations of space, even tanneries wanting to modernize and become more efficient in terms of production and environment management are unable to do so. The present location, in this manner, has become a serious constraint for the growth of the industry.

2.16. Alcohol Production Process

Various traditional fermented beverages are produced in Ethiopia on small scale and usually for local consumption. Tej, Tella, Borde, Korefe, Keribo and Areki are among the varieties of traditional alcohols being consumed in Ethiopia (Tafere, 2015). Since production one of a cause for waste creation the researcher looked the over view of alcohol inputs and outputs.

The word "alcohol" is derived from Arabic word called al-kuhul which is named to many families of alcohol. Alcohols are characterized by one or more hydroxyl (-OH) groups attached to a carbon atom of an alkyl group (hydrocarbon chain). Alcohols may be considered as organic derivatives of water (H_2O) in which one of the hydrogen atoms has been replaced by an alkyl group. According to which carbon of the alkyl group is bonded to the hydroxyl group, alcohols classified to primary, secondary or tertiary (mazel).

Ethanol (ethyl alcohol) is class of organic compound with C_2H_5OH molecular formula. It is the only alcohol used to beverage obtained from fermentation of molasses, plant matters, fruits, grains, and even dairy products (mazel). Absolute ethanol has 0.794kg/lt specific density at 20°C and its boiling point is 78.32oC at 1 atmospheric pressure. The unit measurement of alcohol is Gay Lussac degree (OGL) which is volume by volume (v/v) alcohol to water percentage or proof gallon which is twice of Gay Lussac degree (Perry, 1984). Ethyl alcohol is an important industrial chemical used for dyes, food, medicine, cosmetics and pharmaceutical industries, solvent in the synthesis of organic chemicals, and used as fuel at this time (Perry, 1984).

2.17. Raw Materials used for Production of Ethanol

Ethanol is produced from various kinds of raw materials and is chosen based on the regional availability and economic efficiency (ShinnosukeOnuki, 2008). And these raw materials are:

- Sugar containing materials like sugar cane, sugar beet and sugar sorghum,
- Starchy materials like corn, potato (Quintero, 2008), cassava (Leng, 2008) and wheat (Murphy and Power, 2008) and,

- Lignocellulosic biomass like maize silage (Oleskowicz-Popiel, 2008), barely hull (Kim, 2008), and paper sludge (Marques, 2008).

2.18. Ethanol Production Methods

Ethanol can be produced by the following methods (Data, 2011):

I. Fermentation of carbohydrates (the method used for alcoholic beverages) using yeasts,
II. The hydration of ethylene (the "synthetic" route) using steam and,
III. Biomass waste using bacteria.

Molasses is derived from the Latin ‘mel’ meaning ‘honey’ (Rein P. P., 2006). And it is the residual syrup obtained during sucrose crystallizing in sugar factory. Good quality of molasses, appropriate used yeast strain and process control methods are the main crucial activities in alcohol production. Better quality of molasses with high brix and TRS gives higher alcohol production. And it reduces process water requirement besides improving the quantity of dark stillage formed per litre of alcohol (Qazi, Dr. G.N., 2014). The fermentable sugar content of molasses plays an important role in alcohol yield. Molasses may contain high calcium salts concentration which are yeast growth inhibiter and may encourage glycerol formation. Sterilization of sugar at high temperature in presence of salts (phosphates) and proteins can produce yeast toxins. Yeasts may tolerate 16 to 20% non-fermentable dissolved solids in industrial fermentation (Mirkena, 2014).

2.19. NALF Alcohol and Liquor Production Section

The main process steps of NALF alcohol and liquor factory are molasses treatment section; fermentation section, distillery section and liquor section. And general process flow diagram of NALF is constructed in figure (1) below.

NALF Alcohol and Liquor Production Process

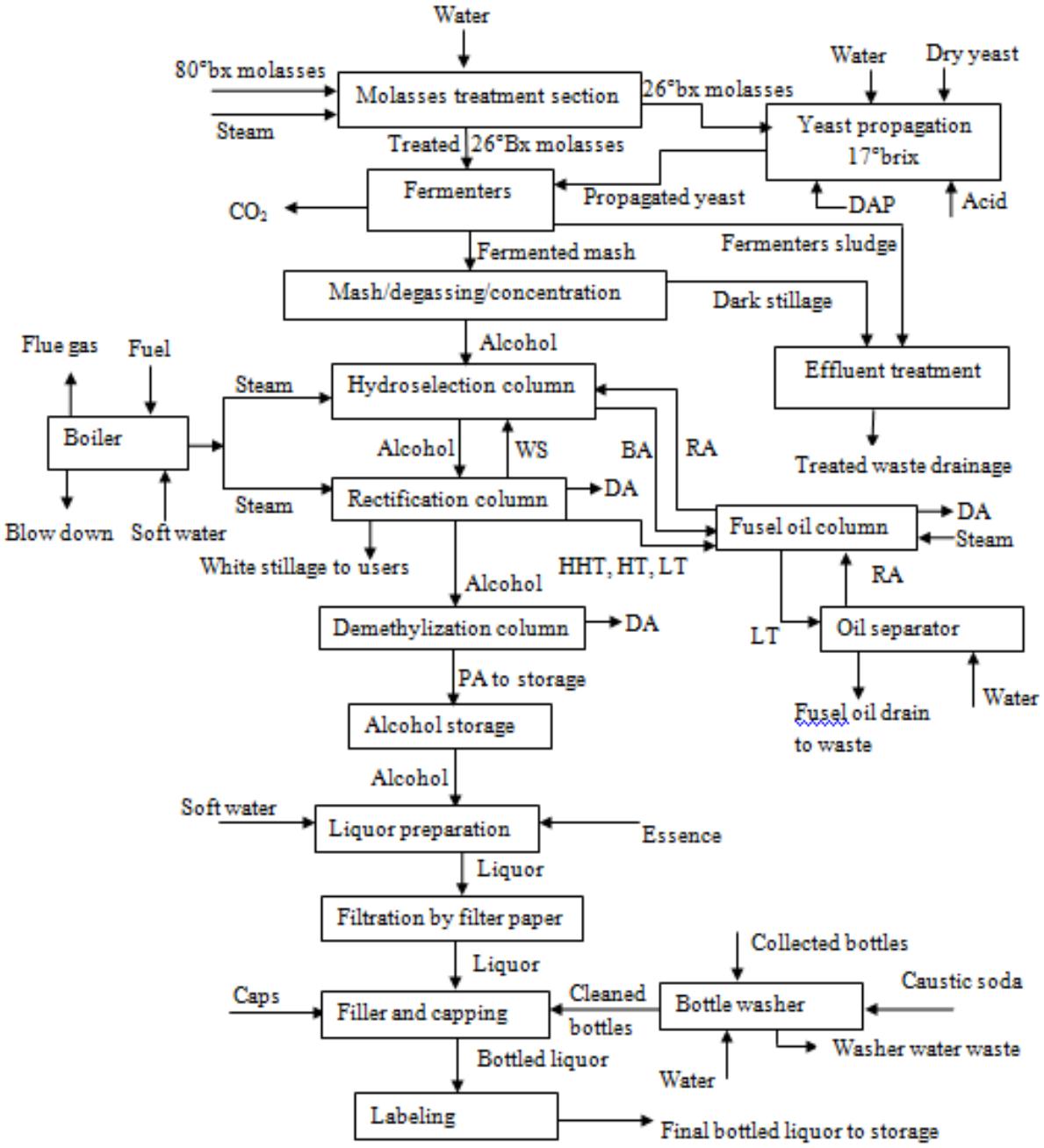


Figure 2.3NALF Alcohol and Liquor Production Process

2.20. Raw materials and utilities used for production of alcohol in NALF

Molasses**,** sulphuric acid**,** yeast**,** DAP (Di-ammonium phosphate), salt, anti-foam and utilities like Water (soft water, process water and cooling water) and steam are the main inputs used in the alcohol production.

Molasses: - Molasses is a brownish black color and a highly viscous material with 78-83obrix which is byproduct of sugar factories and principal ingredient to alcohol production factories. NALF obtained molasses from Methara, Wenji, Fincha or OMO-kuraz sugar factories. But,when there is shortage of molasses especially in summer, NALF use another raw material called technical alcohol for the production of ethanol.

Technical alcohol: - it is ethanol, mostly used for fuel blending purpose which is produced in sugar factory using addition of cyclo-hexane or by molecular sieve tray distillation. It is used as raw material when there is shortage of molasses supply in the market especially during the summer season where the sugar factories totally stopped for maintenance. During this input raw material in NALF production process, molasses treatment and fermentation sections are neglected. But consumption of water is increased for dilution.

Sulphuric acid: - is added in molasses treatment sections and in yeast propagation section. Acid plays a great role in killing micro-organisms and lowering time of precipitation of lime and other scale forming salts obtained in molasses. Also it provides acidic media in fermentation which is suitable for the yeasts during the yeast propagation stage.

Yeast: - Are unicellular microorganisms used to convert the sugar in the treated molasses to alcohol and carbon dioxide. The company mostly uses saccharomyces cerevisiae yeast.

Compressed air: - Air is used to create favorable conditions for yeasts in the yeast propagation section. If there is no sufficient air (O2), yeasts are weak in conversion of sugar to ethanol.

DAP (Di ammonium phosphate):- It is used as a nutrient for the yeasts during yeast propagation. Ammonium ion provides nitrogen for protein nucleic acid synthesis. Vitamins such as biotin, pantothanate and thiamine are stimulatory to yeast growth and ethanol tolerance.

Anti-foam: - is a solution used in the yeast propagation and fermentation tanks to prevent foam formed during fermentation reaction.

Salt: - salt (NaCl) is used to re-generate the zeolite based water softener.

Water supply: - The main source of water supply for the factory is ground water. But, when there is shortage especially in day, additional municipal water is used. Process water is the source of cooling water, soft water and all waters used in the factory.

Water softener: - The factory uses a zeolite based water softener. And softened water is used in boiler, distillery and cooling water sections. As standard, maximum water hardness of factory should be 3.5oF (35ppm) and if it is above this the softener will be regenerated by salt.

Energy supply: - The factory use both fuel energy and electrical energy to produce a liter of alcohol. Fuel energy is used for steam generation in boiler whereas steam is used in distillation and molasses treatment sections. Furnace oil or naphtha oil is used as a source of fuel in NALF. Steam in distillation is used to separate desired alcohol which is ethanol whereas steam in molasses treatment section is used to facilitate the molasses inversion to reducing sugar at acidic media. Electrical energy is used for driving motors of equipment such as pumps, compressors, mixers, office machines and lightings.

CHAPTER THREE

3. Methodology

3.1 Introduction

The aim of this study was to assess the waste management practice and challenges of NALF. This section explains the overall research approach, research design and the methods would use to collect relevant data, present data, analyze data and approaches for the accomplishment of the research.

3.2. Research design and Approaches

3.2.1. Research design

The researcher used both descriptive and exploratory research Approach in order to assist the decision maker in determining, evaluating, and selecting the best course of action to take in a the waste management practice and challenges of NALF. It is based on large, representative samples, for 222 populations. It is difficult to use casual research methods. Descriptive research tends to focus on collecting "standardized" raw data that allow the researcher to create information for precisely answering the how, who, what, where, and when questions concerning the waste management practice and challenges of NALF. Descriptive research might be appropriately employed to address simple types of why questions. In addition depth interview would be used for unstructured, direct, personal interview in which a single respondent is probed by a highly skilled interviewer to uncover underlying motivations, beliefs, attitudes , and feelings on a waste management practice and challenges of NALF. However exploratory research is one type of research design, which has as its primary objective the provision of insights into and comprehension of the problem situation confronting the researcher. It is most commonly unstructured, informal research that is undertaken to gain background information about the general nature of the research problem. It is usually conducted when the research does not know much about the problem and needs additional information or desire new or more recent information and secondary data analyzed in a qualitative way (Creswell,2009).

3.2.2. Research approach

Conceptually research approaches are plans and procedures for research thatspanthestepsfrom broad assu mptions to detailed methods of data collection, analysis and interpretation.

There are three different research approaches: qualitative research, quantitative research and mixed resear ch approach.The researcher makes interpretations of the meaningof the data.Quantitative research approa ch is anapproach for testing objective theories by examining the relationship between variables. These variables, in turn can be measured, typically on instruments, so that numbered data can be analyzed using statistical procedures. Mixed methods approach is an approach to inquiry involving collecting both qualitative and quantitative data, interpreting the two forms of data and using distinct designs that may in volve assumptions and theoretical frame works.That is both qualitative or quantitative approaches have s ome specific limitations and/or problems. However if the researcher employs both approaches at a time, t he weakness of one approach would be solved by the strength of the other approach. As a result, this stud y used mixed method approach using both qualitative and quantitative methods to adequately answer the researcher's proposed research questions on waste management practice and challenges of NALF.

3.3. Population

The sum total of all the units of analysis is called the population or universe (Bailey, 1987). The ideal population for this research should be all members of the in the NAFL. The study population is 222 permanent employees of NAFL.

3.4. Sampling Frame

3.4. 1 Sampling Size

The study selected 143 out of the 222 staff. This would be chosen because they were large Total populations of NALF are 222.Out of these 67 are females and the remaining155 are males. This would be chosen because they were large enough provide a more reliable sample for the study. (Yamane 2011;).The number of samples need for the study would be determined by the following general formula enough provide a more reliable sample for the study. (Yamane 2011;).The number of samples need for the study would be determined by the following general formula.

$$\boldsymbol{n = \frac{N}{1 + N(e^2)}}$$

Where, N, is total population, n, is sample size and e. is an error.

$$\boldsymbol{n = \frac{222}{1 + 222(0.05^2)}}$$

n=143

This sample site would be selected randomly by using lottery means from the total population.

3.5. Data sources and Data collection Instruments

Data sources

The researcher used both primary source & secondary source of data. Source of Data structured questionnaire and interview question was given to a sample of a population and designed to elicit specific information from respondents. Structured data collection is the use of a formal questionnaire that presents questions in a prearranged order.

Primary Data; the primary data wascollected by using questioner and interview.

Questionnaires/survey;the questionnaires at most effort try to translate research objectives into specific questions. The respondent can answer and try to motive the respondent to cooperate with the survey and to provide the information correctly.Primary sources were responses of employees of NALF, while secondary sources was written document of the company.

Data collection Instruments

a) **Primary data**:-Primary data was collected using a structured questionnaire, for the employee and interview schedules for the human resource and recruitment manager and Area management members. A structured questionnaire was used because it is easy to fill, and respondents could provide the information in confidence at their own time. The researcher collected through questionnaires, interview questions to conduct primary data. The secondary data would be also collected from books, Journals, magazines, and Newspapers, websites.

3.6. Sampling Techniques

The researcher would use simple random technique. Elements are selected from each stratum by random procedures, usually by Simple Random Sampling. Stratified random sampling was useful method for data collection since the population was heterogeneous. In this method, the entire heterogeneous population is divided in to a number of homogeneous groups, usually known as Strata; each of these groups was homogeneous within itself. The reason behind is to minimize the time required for data analysis and the company's operations system was made the process of primary data collection is difficult to the target

population. Stratified random sampling can give higher precision with the same sample size, alternatively, the same precision with a smaller sample.

3.7. Data Collection Instruments

a) Primary data:-Primary data was collected using a structured questionnaire, for the employee and interview schedules for the human resource and recruitment manager and Area management members. A structured questionnaire was used because it is easy to fill, and respondents could provide the information in confidence at their own time.

3.8. Data Collection Procedure

Permission was being asked in the case of NALF to allow the study to be carried out in their company. Questionnaires with an introductory letter explaining the study‘s goals and guaranteeing confidentiality, Interview dates, time and venue will be agreed upon by each interviewee. The interviews will be personal and lasted between 20 and 30 minutes. The interviews were conducted. And secondary data was collect from the concerned body. The researcher used both primary and secondary data collection methods.

3.9. Data Analysis Methods

The collected data was screen for any missing values that could cause a problem in analysis of the research. Then descriptive statistical analysis was presenting a form of frequency, percentage, mean and standard deviation. SPSS was use for analyzing data. Collected data was analyzed by percentages, tables, graph computed. Data was presented in tables and percentages by using SPSS. Document analysis was done to cross check, supplement and confirm information will be obtained from the questionnaires.Data Collection Procedure Permission was asked in the case of NALF to allow the study to be carried out in their company. Questionnaires with an introductory letter explaining the study‘s goals and guaranteeing confidentiality.

3.10. Ethical Considerations

It is required to write and follow ethical measures for any research. The researcher tried to establish good relationships with all the respondents, because the selection of potential and appropriate people play important role for the reliability and validity of the quantitative data was made. Those informants in this research first were given their informed consent to participate in the structured questionnaires’’ and observations of documents. Furthermore, questions would make simple and clear to avoid any

misunderstanding and avoid ambiguity, as well as sensitivity to the pieces of information the informants will be provide to the researcher.

3.12. Reliability and Validity

3.12.1. Validity

According to Kothari (2004), validity refers to the extent to which a test measures what we need to evaluate. It is about finding out if the data collected is relevant to the problem being investigated. The validity of the research considered while developing close-ended questionnaires and semi structured interviews checked by benchmarking the related literature review and questionnaires to generate a valid response. The instrument of data collection validity is checked by asking other peoples who have made research in the same area and those who has know-how on the studied area for feedback and asks my advisor for approval before conducting collection.

3.12.2. Reliability

Researchers consider a measure to have adequate reliability if Cronbach‟s alpha coefficient Reliability refers the degree to which the results of the research are repeatable (Walliman, 2006). It is about absence of difference in the research findings if the research were repeated. To confirm the applied researcher approach is consistent or not, the research has been supported by using reliable sources of information such as related journals, articles, books, websites, and work papers and studies related to the studied area The reliability of the interviews also maintained by having interview with each manager to ensure the reliability of the information obtained by cross checking the respective responses gained from them. The Likert scale questionnaire item‟s reliability was checked by the application of the Cronbach Coefficient Alpha using SPSS software for the computations of internal consistency. As a rule of thumbexceeds 0.7 (Leary, 2012).Therefore, that scaled item in the questionnaire was found to be reliable because the Cranach’s alpha coefficient correlation was calculated which is 0.790 which suggested good internal consistency.

Table 3.1 Reliability Statistics

S/N	Variables	Crobache's Alpha	Crobach's Alpha Based on Standard	No. of Items
1	Major sources of waste at NALF	0.795	0.778	5
2	What is level of existing waste management practice at NALF	0.785	0.778	14
3	What are the existing wastes management challenges at NALF	0.793	0.778	9
4	What do you suggest a waste management method for the waste at NALF.	0.787	0.788	7

Table1 Reliability Statistics

CHAPTER FOUR

4.1. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1.1. Introduction

The main objective of this chapter is to present, analyze and interpret the data collected from the respondents by using survey questionnaire and interview questions. The data obtained from the questionnaire was analyzed by using Statistical Package for Social Sciences (SPSS) version 20. Out of (143) questioners distributed to the respondents (134) were properly filled and collected, the remain (5) questioners were not correctly filled and 4 questioners could 'not be returned.

Table 4.1 Demographic variable of respondents

S/No	Respondents' Variable	Number of respondents'(Frequency)	% of respondents'
1	Gender		
	a) Male	92	68.7
	b) Female	42	31.3
2	Employee's Service year at N.A.L.F		
	a) less than one year	0	0
	b) 1-5 years	28	20.9
	c) 6-10 years	49	36.6
	d) 11-20 years	40	29.9
	e) Above 20 years	17	12.7
3	Employee's staying on current position		
	a) less than one year	6	4.5
	b) 1-5 years	76	56.7
	c) 6-10 years	45	33.6
	d) 11-20 years	7	5.2
	e) Above 20 years	0	0
4	Educational back ground		
	a) <10 completed	0	0
	b) >10 completed	10	7.5

	c) Certificate holder	4	3
	d) Diploma holder	17	12.7
	e) Degree holder	81	60.4
	f) MA/MS holder	22	16.4
	g) PHD holder & above	0	0
	Total	134	100

Source:- Survey data 2021

As it can be seen from the above table 4.1 the gender of the company varies. Accordingly it indicates that out of the total 134 of respondents 92 (68.7%) are males and 42 (31.3%) are females. This shows majority of the respondents are males. The employee's service year at N.A.L.F indicates that out of the total 134 respondents all employees have more than one year experience on the organization that is employees having an Experience from 1-5 years were 28 (20.8%), 6-10 years were 49(36.6%), 11-20 years were 40(29.9%) and having above 20 years' experience were 17(12.7%). This shows that out the total 134 respondents 106 (79.2%) having an experience more than 6 years which helps for the researcher to get accurate information about the waste practice and challenges on N.A.L.F because of the employees having long year experience on the organization. The employees staying on their current position were less than one year 6 (4.5%), 1-5 years were 76 (56.7%), 6-10 years were 45 (33.6%), 11-20 years were 7(5.2%) and no employees were stay more than 20 years on their current position. The educational back ground from the total 134 respondents were no employees less than 10 grade completed, more than 10 grade completed 10 (7.5%), certificate holder 4 (3%), Diploma holder 17 (12.7%), degree holder 81 (60.4), MA/MSc holder 22 (16.4%) and no PHD holder employee under the respondents. This shows that more respondents were diploma and above holders and the researcher consider them having good awareness about the topic under the study to fill the questioner at less barriers.

4.2. Descriptive Analysis

This section is presented the descriptive statistics of the major sources of wastes at N.A.L.F. The response rate of the respondents presented, analyzed and interpreted as follows. . The rule for this analysis is that any mean responses of1-1.49, 1.50-2.49, 2.50-3.49,3.50-4.49and 4.50-5.00 are rated very low, low, moderate, high and very high sources of wastes respectively

4.2.1. The major sources of waste at N.A.L.F

Table 4.2Major sources of waste at N.A.L.F Descriptively

S/NO	Variables	N	mean	Min	Max	Sta.Deviation
1	There is molasses silage at NALF	134	4.3358	1.00	5.00	0.88381
2	There is extracted waste from fermentation which is silage at NALF.	134	4.276	3.00	5.00	.52590
3	There is extracted waste from Distillery which is silageat NALF	134	4.358	3.00	5.00	.59323
4	I have observed wastages CIP (clean in Place) of Battles and others	134	4.254	2.00	5.00	.78219
5	I have observed solid wastes breakage of bottles, metal closure and different type of labeling wastages at NALF	134	4.2239	1.00	5.00	.89813
	Total		21.4477			3.68326
	Average		4.28954			0.736652

Source: - Survey data 2021

Table 4.2 shows the descriptive statistics for major sources of wastes at N.A.L.F. The standard deviation with scores of low and high standard deviation is 0.59325-0.89813 respectively. According to Zaidatol&Bageheri (2009) standards, 5 point likert scale the mean score values interpreted as follows mean responses of 1-1.49, 1.50-2.49, 2.50-3.49, 3.50-4.49 and 4.50-5.00 are rated very low, low, Moderate, High and Very High respectively. The mean variable of all the questions from question one (1) to five (5) are all under the range of high that is, under the range 3.50-4.49. The analysis has a minimum score of 1 and maximum score of 5.As it can see from the above descriptive table and the respondents gave a high amounts, were wastes sourced almost similar values on the organization from all the variables requested for them. That is, even though all the variables had a bit difference on mean value all the variables almost having similar influence on generated wastes on the organization.

4.3. How do you evaluate level of existing waste management practice at N.A.L.F.?

Table 4.3.evaluate level of existing waste management practice at N.A.L.F Descriptively

S/NO	Variables	N	mean	Min	Max	Sta.Deviation
1	There is good waste management practice at NALF	134	4.4925	3	5	0.63419
2	I am happy with the waste management practice at NALF	134	4.3657	3	5	0.55578
3	NALF recovers wastes	134	1.9030	1	4	0.83953
4	NALF reuses wastes	134	1.5299	1	3	0.67934
5	The residents are suffering from pollution discharged from NALF	134	1.8731	1	5	1.21656
6	NALF recycles wastes	134	1.6194	1	4	0.69146
7	There is modern effluent treatment plant in the NALF	134	4.2985	2	5	0.94216
8	The NALF Discharges waste directly to river	134	1.6194	1	3	0.55920
9	NALF has got enough lorries to discharge waste	134	2.1866	1	5	1.01986
10	There is bad smell in the NALF	134	3.7239	1	5	1.33429
11	NALF company gets benefit from waste management financially	134	3.7239	1	5	1.36768
12	The NALF disposes wastes untreated to the river nearby	134	1.6269	1	4	0.78205
13	NALF has complained of pollution community	134	2.0821	1	4	1.17011
14	Employees are happy at organization on waste management	134	4	2	5	1.07606
	Total		39.0449			12.86827
	Average		2.789			0.9192

The response rate of table 4.4 of the respondents presented, analyzed and interpreted as follows.

The rule for this analysis is that any mean responses of 1-1.49, 1.50-2.49, 2.50-3.49, 3.50-4.49and 4.50-5.00 are rated very low, low, moderate, high and very high were practiced waste management at N.A.L.F respectively.

Table 5 shows the descriptive statistics for evaluation of level of existing waste management practice at N.A.L.F. The standard deviation with scores of low and high standard deviation is 0.55578-1.36768 respectively. The mean value of the questions 1, 2, 7, 10, 11 and 14 under the range of mean value 3.50-4.49 which is grouped under high level of waste management practice at N.A.L.F. whereas the mean value of the Question 3, 4, 5, 6, 8, 9, 12 and 13 under the range of mean value 1.50-2.49 which is grouped under low level of waste management practice at N.A.L.F. The analysis has a minimum score of respondents 1 and maximum score of 5. As it can be seen from the above descriptive table and the respondents gave a high and low levels waste management practice at N.A.L.F according the kind of Questions and the researcher discussed detail each questions.

4.4. What are the existing wastes management challenges at N.A.L.F.

Table 4.4the existing wastes management challenges at N.A.L.F Descriptively

S/NO	Variables	N	mean	Min	Max	Sta.Deviation
1	There are number of challenges during waste management of N.A.L.F	134	4.3582	2	5	0.92096
2	There are economic challenges for waste management practice at N.A.L.F	134	3.9478	2	5	0.89541
3	There are technological challenges for waste management practice at N.A.L.F.	134	1.9254	1	4	1.11468
4	There is commitment problem for waste management practice by top managers	134	1.9403	1	5	0.90746
5	There is governmental challenge for waste management practice	134	3.8731	1	5	1.30598
6	The country rules and regulations of waste management are not exercised	134	2.00	1	5	1.28613
7	I consider that waste management practice appropriate to keep me motivated for working.	134	3.6343	1	5	1.39570
8	I believe that budget for waste management is wastage	134	1.8881	1	4	0.88139
9	Media has raised my awareness about waste management.	134	1.8358	1	5	0.97483
	Total		25.403			9.68254
	Average		2.823			1.07584

This section is presented the descriptive statistics of the major sources of wastes at N.A.L.F. The response rate of the respondents presented, analyzed and interpreted as follows. . The rule for this analysis is that any mean responses of 1-1.49, 1.50-2.49, 2.50-3.49, 3.50-4.49 and 4.50-5.00 are rated very low, low, moderate, high and very high about the existing waste management challenges re spectively.

Table 4.6 shows the descriptive statistics to know the existing wastes management challenges at N.A.L.F. The standard deviation with scores of low and high standard deviation is 0.88139-1.39570 respectively. The mean value of the questions 1, 2, 5 and 7 under the range of mean value 3.50-4.49 which is grouped under high level of existing wastes management challenges at N.A.L.F. whereas the mean value of the Question 1, 2, 5 and 7 under the range of mean value 1.50-2.49 which is grouped under low level of existing wastes management challenges at N.A.L.F.

The analysis has a minimum score of respondents 1 and maximum score of 5. As it can be seen from the above descriptive table and the respondents gave a high and low levels according the kind of Questions and the existing wastes management challenges at N.A.L.F. The researcher discussed detail each question

4.5. What do you suggest a waste management method for the waste at NALF

Table 4.5.waste management method for the waste at NALF Descriptively

S/NO	Variables	N	mean	Min	Max	Sta.Deviation
1	The N.A.L.F recover wastes	134	1.9030	1	4	0.94088
2	The N.A.L.F reuses wastes	134	1.8134	1	4	0.87718
3	N.A.L.F recycles wastes	134	1.7761	1	4	0.73210
4	N.A.L.F directly discharge wastage to the Environment	134	1.8582	1	5	1.09100
5	There is modern effluent treatment plant at N.A.L.F	134	4.5149	1	5	0.57170
6	N.A.L.F use any purification method	134	4.000	3	5	1.15035
7	Enough lorries to discharge wastes	134	1.7463	1	5	1.04548
	Total		17.6119			6.40869
	Average		2.52			0.91553

This section is presented the descriptive statistics of the major sources of wastes at N.A.L.F. The response rate of the respondents presented, analyzed and interpreted as follows. . The rule for this analysis is that any mean responses of 1-1.49, 1.50-2.49, 2.50-3.49, 3.50-4.49 and 4.50-5.00

are rated very low, low, moderate, high and very high grouped the respondent of their suggestion about w aste management method for the waste at N.A.L.F.

Table 4.5 shows the descriptive statistics to know their suggestions of individuals included under the study about waste management method for the waste at N.A.L.F. The standard deviation with scores of low and high standard deviation is 0.57170-1.15035 respectively. The mean value of the questions 7 range of mean value 4.5-5.00 which is grouped under very high level; the question 5 range of mean value 3.50-4.49 which is grouped under high level and the mean value of question 1, 2, 3, 4, and 7 range from 1.5-2.49 which is low level of suggestion of respondents about waste management method for the waste at N.A.L.F.

4.6. Interview Results and Discussions

They are Five interviewee are participated in this study. These are the chief Executive officer of the NALF, project manager of the NALF, Facility management head officer, Production department head officer and human resource head officer of NALF. And the results are summarized and analysis based on similarity and difference of ideas bringing to gather according the following.

Beside water used for alcohol product and that lost in by product, there is wastewater which is one of most significant waste products of alcohol operations. This effluent is composed of organic material from process activity. NALF has installed in-house wastewater treatment plant treating their own waste before discharging or re-using. NALF has anaerobic waste water treatment process. In order to reduce cost associated with wastewater treatment disposal and dependence on furnace for steam generation, installed an anaerobic digester to treat waste leaving its in Gauteng to reduce the COD of the wastewater before leaving the site. NALF produces organic residues comprising of spent grains, spent hops, yeast, tub, and sludge. Alcohol process also produces liquid waste such as weak wart and residual alcohol that can enter the effluent stream. The main source of residual alcohol include process tanks, filters, pipes, alcohol rejected in packaging area, returned bottles and broken bottles in the packaging area. This residue is collected and returned to the process. Packaging is an important part of alcohol process however it can end up impacting the environment with waste. The use of recyclable packaging reduced a burden that could be placed on the environment due to volume of waste generated.

NALF data availability for the sewerage systems is good and reconciles well. NALF bio solids data appears complete. Hazardous liquid waste generation estimated is not accurate as the NALF data sed in the calculation include some solid wastes. This may explain the negative generation for several waste types. NALF operate a waste tracking system for hazardous liquid wastes (trackable liquid wastes) moved within the state. The internal tracking system records the physical state, the facility receiving, and the proposed treatment or management. NALF suggests that treatment facility annual reporting data that details specific treatment facility operations and the ‘mass balance’ of the liquids received and the fate of these liquids received. This information could be used to complement tracking system data to complete the data set and build a more complete. NALF tracks the tonnages of solidified wastes from treatment facilities that are sent to customers. These tonnages represent an important interface between liquid and solid waste

disposal data. These volume equivalents have not been identified as the volume of hazardous liquid wastes disposed in the solid waste stream because not all of the tonnage is the liquid waste. The solidified wastes are made up of the liquid volume, binding agents, and sometimes other solid wastes, so to allocate this tonnage to liquid waste counted within the solid waste data would be inaccurate.

NALF operate chemical collection program that provides some data on the amount of liquid and solid hazardous wastes collected from the departments worked with different chemicals. However, without primary research into the total consumption of hazardous liquid waste being served by the program it is not possible to estimate the amounts of hazardous liquid wastes that are being disposed to the solid waste stream or to sewer.

Waste management problem is complex because of scientific, technical, economic and social factors. It costs around 40 million Ethiopian birr to build advanced secondary effluent treatment plant, educated man power. For this reason it is expensive ,it needs high capital, educated man power, Similarly, it is observed that lack of financial resources, transportation systems and lack of commitment by the top managements of NALF.NALF enable reporting of the levels of liquid hazardous waste generation, movement, treatment, recycling, and landfill. If the above is achieved, NALF states and territories would be able to report on the levels of liquid waste that are in the factory's total hazardous waste volumes/tonnes. Waste treatment needs to be counted separately to recycling figures as a significant proportion of the materials received at treatment facilities are disposed to sewer, or customer. NALF could investigate the site specific information that is available on the fate of materials received by hazardous waste treatment facilities. Where available, this information could be used to complement tracking system data weaknesses or noncompliance and enable reporting on the levels of hazardous waste recycling, energy recovery, disposal to sewer, and volume disposed to landfill as solidified waste. Data was not available to estimate the levels of chemicals that are being generated. Additional research is required to estimate consumption volumes of common chemicals to enable estimates of generation to be made. Once an estimation of generation is made, it would be possible to estimate the volumes of chemicals being disposed in bins and to the sewer. NALF does not operate a waste tracking system for liquid wastes.

The impacts are over all to animals, plants, human being totally the ecosystem as a whole. NALF does not operate a hazardous waste NALF tracking system for internal state waste movements,

although, a tracking system is currently under development. The key liquid waste management pathways (from generation through to recovery or disposal) were found to be consistently followed .Wastes are often in a partial liquid state, commonly referred to as ‘sludge’s’ which are a significant ‘grey area’ between liquid and solid waste classifications and represent a significant area of potential overlap or confusion in liquid and solid waste data accounting. Hazardous waste facilities receive significant amounts of ‘sludge’ wastes for treatment. During treatment, sludge’s are normally separated into the liquid and solid components which are then managed into recycling, or disposal to sewer. Wastes classified by the generator as sludge are difficult to allocate accurately to.

The solid waste consists of raw materials used during the alcohol procedure, filtering aids and containers used for packaging the alcohol. Solid waste management and typical solid wastes from alcohol include: spent grains, tub, spent yeast, diatomaceous earth slurry from filtration, and packing materials. The amount of waste generated can be broken down into two groups. Macro-Pollutants ;The macro pollutants that require management before entering the municipal system would be listed as soon as the pollutant load data becomes available. Micro-Pollutants The micro pollutants that require management before entering the municipal system would be listed as soon as the pollutant load data becomes available. Pollutants of Environmental Concern Thekieselguhr or diatomaceous earth used as a filtration media needs to be disposed of in a specific manner due to it not being fit for cattle consumption. Various liquors have raised concerns of methods for disposing of this filtration media due to no prescribed method being stipulated. Currently this is disposed of at municipal landfill sites which raise environmental concerns regarding its biological degradation.

Yes NALF were treated wastes properly according the rule and regulation of the country. As a result there is no environmental impact because the wastes are well treated through the evaporator and biological treatments to reduce the wastes COD and BOD to the standard amount not impacted the environment 250mil/liter and 60mili/liter respectively**.**

All the three types of effluent treatment plant are available on NALF for treating the wastes.

1. Primary effluent treatment plant called the evaporator used to separate the liquid and solid wastes

2. Secondary effluent treatment plant called the biological treatment which is the liquid waste treated biologically to reduce COD and BOD amounts.
3. Tertiary effluent treatment plant called the Circular decanter used for multiplication of bacteria's to make the silage on the bottom and liquid waste on above parts.

NALF water resources involve catchment management, river systems, water storage, water abstraction and return-flow management. Integrated management techniques are required to ensure that water is both protected and utilized to its full potential. Majority of the NALF adopted water saving technologies that promote prevention, control, and minimization and recycling to the extent possible without compromising the hygienic standards. These technologies have water meters installed & maintained weekly.

Pasteurization,

NALF uses flash pasteurization instead of tunnel pasteurization to reduce water requirement of flash pasteurization. Cleaning, some of the alcohol uses automated bottle washing fixed spray injectors to reduce water usage. Water is recycled from one process to the next, for example, in cooling, pasteurization, cleaning and bottle washing processes. Pollution prevention and control are best practiced through effective management, maintenance, and housekeeping in a process that incorporates water conservation and recycling, and disposal of solid wastes as by-products. Wherever water is used there is often an opportunity for conservation. Some options that may be considered include:

• High-pressure, low-volume hoses for equipment cleaning

• Recirculating systems on cooling water circuits

Water Pinch Analysis

Water pinch analysis tool offer insights on how water is used in different processes with a goal to reduce the environmental impacts of water. Water Pinch Analysis, a systematic technique for analyzing water networks and reducing water costs for processes has helped companies to systematically minimize freshwater and wastewater volumes.

Water Foot printing

Water foot printing is applied well; it is very useful from a business perspective, helping identify the scale of water use in water-scarce areas and the potential business risks that arise. The key test of a water footprint is whether it helps a business to take better operational decisions concerning how it manages its plants, how it works with suppliers and how it engages with governments, to reduce business risk and improve environmental sustainability. Water foot printing is primarily focused on quantitative water supply issues. In terms of actual quantitative footprint, the NALF footprint is at liters of water per liter of alcohol (l/l).

Wastewater Management;

Water recycling is the reuse of water for the same application for which it was originally used. Recycled water requires treatment before it can be reused. Cooling water and wash water recycling are the most widely used water recycling practices. Identification of water re-uses opportunities and Cooling Water should be used when considering water reuse and recycling in alcohol. Recycling water within a cooling system greatly reduce water consumption by using the same

Energy

Pinch technology aids to facilitate recycling of heat (energy) between processes. Heat exchangers allow numerous process streams to come in contact with one another to facilitate heating of cold streams and the cooling of hot streams. The practice is utilized in wart boiling, cooling, pasteurization and bottle cleaning processes.

The total budget NALF spent for chemical cost, utility cost or energy cost, water cost and labor costs were 6 million per year to manage the wastes and the organization waste treatment plant has a capacity of 260 tones wastes treated per day.

The solid waste consists of raw materials used during the alcohol procedure, filtering aids and containers used for packaging the alcohol. Solid waste management and typical solid wastes from alcohol include: spent grains, trub, spent yeast, diatomaceous earth slurry from filtration, and packing materials.

Liquid Waste

NALF treated water at the source not as part of the liquor process. In some alcohol effluent flows to an underground balancing tank with an average retention time of one week and the effluent is balanced before being released to river. NALF with the plan to construct WWTP have a sump that the wastewater goes into. The liquid waste is considered to be the effluent that leaves the alcohol which enters the municipal water system. It should be noted that this effluent includes water used for cleaning and packaging. NALF presents the pollutant, the load of the pollutant in the effluent and the measurement unit used for the pollutant being evaluated.

There are different types of stock holders used for evaluating wastes at NALF. First the organization made meeting with the community to give information about waste management of NALF and making to believe on it.

Secondly the organizations respected the rules and regulation of Addis-Ababa environmental protection authority and open its door for evaluation by them.

Lastly the organization also available resources for the employees for protected them self from different chemicals.

CHAPTER FIVE

5.1. Conclusion and Recommendation

The main objective of this chapter is to present, analyze and interpret the data collected from the respondents by using survey questionnaire and interview questions. The data obtained from the questionnaire was analyzed by using Statistical Package for Social Sciences (SPSS) version 20. Out of (143) questioners distributed to the respondents (134) were properly filled and collected, the remain(5) questioners were not correctly filled and 4 questioners could ‘not be returned.

Out of the total 134 of respondents 92 (68.7%) are males and 42 (31.3%) are females. This shows majority of the respondents are males; from the total 134 respondents 79.2% respondents were having more than 6 years’ experience at NALF and the remaining respondents 20.8% have an experience from 1-5 years; from the total 134 respondents no respondents are less than 10 grade complete and 89.5% of the respondents are above diploma holders.

Most of the employees were positively response having average mean value 4.28954 which is under the range of high.So that the major sources of wastes are because of molasses silage, extracted waste from fermentation which is silage, there is silage from there is waste at N.A.L.F from molasses silage Respondents, clean in place and breakage of bottles, metal closure and type of labeling.

Most of the respondents were positively response that is 4.4925 mean value there was good management practice at N.A.L.F; It shows that most respondents were positively response which was 4.3657 mean value means the employees under the study were happy with waste management practice at N.A.L.F, high value of negative response which was 1.9030 mean value N.A.L.F was not recovering wastes; Respondents said that no residents were suffering from pollution discharged from N.A.L.F and 1.8731 mean value of respondent said that residents were suffering pollution discharged from N.A.L.F. 2.1866 mean value .

4.3582 mean value of the respondents said that there were number of challenges during waste management practice; 3.9478 mean value of respondents believed that NALF economic Challenge for waste management properly; 1.9254 mean value of the respondents NALF had not technological challenges for waste management practice; about 1.9403 mean valueof respondents said that there is no top management commitment problem for waste management practice; about 3.8731 of the respondents agreed there were governmental challenges for

wastemanagement practice at N.A.L.F; 2.00 mean value of the respondents said that the country rules and regulation NALF is exercised and about 1.8358 mean value of the respondents said that media had not raised the individual awareness about waste management.

There is wastewater which is one of most significant waste products of alcoholic operations. This effluent is composed of organic material from process activity. NALF has installed in-house wastewater treatment plant treating their own waste before discharging or re-using. Installed an anaerobic digester to treat waste leaving its in Gauteng to reduce the COD of the wastewater before leaving the site. NALF produces organic residues comprising of spent grains, spent hops, yeast, trub, sludge. The solid waste has commercial value and is sold as by-products for cattle feed. Alcohol process also produces liquid waste such as weak wart and residual alcohol that can enter the effluent stream. The main source of residual alcohol include process tanks, filters, pipes, alcohol rejected in packaging area, returned bottles and broken bottles in the packaging area. This residue is collected and returned to the process. Packaging is an important part of alcohol process however it can end up impacting the environment with waste. The use of recyclable packaging reduced a burden that could be placed on the environment due to volume of waste generated.

NALF data availability for the sewerage systems is good and reconciles well. NALF bio solids data appears complete. Hazardous liquid waste generation estimated is not accurate as the NALF data in the calculation include some solid wastes. This may explain the negative generation for several waste types. NALF operate a waste tracking system for hazardous liquid wastes moved within the state. The internal tracking system records the physical state, the facility receiving, and the proposed treatment or management. While NALF reporting of these movements was not identified, it appears that the tracking system collects a good level of information which could be used to complete this report's missing information. It is understood that the liquids treated is recycled, sent to sewer, solidified and sent to landfill. The solidified wastes are made up of the liquid volume, binding agents, and sometimes other solid wastes (such as soils), so to allocate this tonnage to liquid waste counted within the solid waste data would be inaccurate.

NALF operate chemical collection program that provides some data on the amount of liquid and solid hazardous wastes collected from the departments that used chemicals to produce and reprocess products. However, without primary research into the total consumption of hazardous liquid waste being served by the program it is not possible to estimate the amounts of hazardous liquid wastes that are being disposed to the solid waste stream or to sewer.

Data was not available to estimate the levels of chemicals that are being generated. Additional research is required to estimate consumption volumes of common chemicals to enable estimates of generation to be made. Once an estimation of generation is made, it would be possible to estimate the volumes of household chemicals being disposed in bins and to the sewer vs. what is recovered by collection programs. Bio solids data appears to be complete. The key liquid waste management pathways (from generation through to recovery or disposal) were found to be consistently followed by the states and territories. Wastes are often in a partial liquid state, commonly referred to as 'sludge's' which are a significant 'grey area' between liquid and solid waste classifications and represent a significant area of potential overlap or confusion in liquid and solid waste data accounting. Hazardous waste facilities receive significant amounts of 'sludge' wastes for treatment. During treatment, sludge's are normally separated into the liquid and solid components which are then managed into recycling, sludge's are typically separated into solid and liquid wastes during treatment, the solid and liquid waste components should be reported appropriately within solid and liquid waste data. However, sludge state wastes remain an area of uncertainty and potential data overlap between solid and liquid waste reporting for the following reasons. The solid waste consists of raw materials used during the alcohol procedure, filtering aids and containers used for packaging the alcohol. Solid waste management and typical solid wastes from alcohol include: spent grains, trub, spent yeast, diatomaceous earth slurry from filtration, and packing materials. Best Practices of NALF are, pasteurization, water pinch analysis, water foot printing, wastewater management,

5.3. Recommendations

The practice of waste management and challenges reveals a variation with that of theoretical view of the knowledge area. For which the company should recognize and give greater emphasis to the identified gaps and ensure the effective management of its waste management practice and challenges. Thus, the researcher provides the following recommendations through identifying focal points that would be helpful to the company for waste management in valuable ways.

- Waste management processes should be implemented not only in the planning but through all activities and needs to be integrated with the waste management plan. Waste management practice should be considered as an iterative/continuous process throughout the day to day activities each individual of the employees of the company. The human resource should give training to the employees how waste is managed in each their departments. To some up, the waste Management process should be implemented in all phases of the departments of NALF to make it be practical and measurable.
- The Top management should follow and implement a well-developed calleda modified WMSthat suggests how to manage unexpected uncertainties of wastes which enables it to have a defined/standard waste management process since having well developed guideline and defined/standard waste management system only does not guarantee enough to handle wastes unless they have been in practice in the Organization.
- The company should assign responsible person or department, whose primary responsibility is assuring the implementation of the waste management system of the NALF in each department.
- The monitoring and review process should be integrated into existing processes so that it adds value and supports the successful achievement of objectives. Implementations of waste monitoring and control activities are crucial to the successful management of waste in any department of the company. The weak practice of waste monitoring and controlling in the company should be improved and done in accordance with the goal and objective of the organization.
- The federal, regional ,environmental protection authorities have to be strictly enforced by the federal and regional environmental protection authorities to control improper waste disposal.

- NALF should improve their waste management practice management by implementing different systems and mechanisms that will help to reduce, reuse,recover,recycle, treat and properly dispose
- The government of Ethiopia should give an attention to industries to manage wastes according the rule and regulation of the country. And the government givesawareness for industries through media to have knowledge about waste how much it pays costs the country because of poor waste management practice and planning of the industries. Such a strategy includes government collaboration with key stakeholders and sharing of re sponsibilities and information. However, better WM services in NALF will depend on mu nicipalities strengthening their role.
- Now a day waste is a resource of one industry or firm if well managed and practiced. Therefore the top management of NALF should be implemented

  WMS package includes a comprehensive waste recycling, recovering, reusingand transporting system for the waste would taking into account social, economic, political, institutional, and environment al aspects. The modified WMS take into account NALF needs and conditions and then the most appropriate management techniques would be included in the treatment package.

Appendix A

Bibliography

- *Africa Business, 2016. Addis Ababa: The 'Dubai' of Africa. http://www.africa-business.com/features/addis-ababa-business.html [Accessed April 2016]*
- *The cycle of plastic waste: An analysis on the informal plastic recovery system in Addis Ababa, Ethiopia.*
- *Trondheim, Norway: Norwegian University of Science and technology department of geography. Available at: https://brage.bibsys.no/xmlui/handle/11250/265502 ChaibFadela, Setiogi Sari, Osseiran Nada, Taveau Veronique, 2008. Poor sanitation threatens public health. at: http://www.who.int/mediacentre/news/releases/2008/pr08/en/ Accessed May 2016.*
- *ABEBAW, H., Leather Industry and Environmental Challenges, The Case of Haffede Tannery, Addis Ababa. 2015.*
- *ABEBE, Z., Tannery Wastewater Management problems in Ethiopia, The Case of Batu Tannery, Addis Ababa. 2011.*
- *AFRICAN DEVELOPMENT BANK GROUP. Eastern Africa's Manufacturing Sector. Ethiopia Country Report. 2014.*
- *GEBRU, H., TADESSE, N., ARA KONKA, B., Impact of Waste Disposal from Tannery on Surface and Groundwater, Sheba Leather Factory near Wukro, Tigray, Northern Ethiopia. International Journal of Earth Sciences and Engineering.*
- *UNIDO: UNITED NATION INDUSTRIAL DEVELOPMENT ORGANIZATION, Introduction to treatment of tannery effluents, Vienna. 2011.*
- *THE WORLD BANK WASHINGTON, D.C., Decision Makers' Guide to Municipal Solid Waste Incineration. Washington D.C. 1999.*
- *The Involvement of Micro and Small Enterprises in Solid Waste Management Services in Addis Ababa: The Case of Bole and Arada Sub-cities, Ethiopia*
- *AbejeHiruy, 2009. An Assessment of Institutional Capacity for Municipal Solid Waste Management: The Case of Sanitation, Beautification and Parks Development Agency of the City of Government of Addis Ababa, Ethiopia .*

- *Abel Afon, 2007. An Analysis of Solid Waste Generation in a Traditional African city: the Example of Ogbomoso, Nigeria International Institute for Environment and Development. Achankeng Eric, (2004).*
- *DerejeTadesse, 2001. Financial Urban Infrastructure and Services in Ethiopia: The Case of Solid Waste Management in Adama Town, Ethiopia*

- *Ozgunay et al., 2017. The Challenges of Solid Waste Management in Urban Areas, the Case of Debremarkos Town, Addis Ababa University, Ethiopia.*
- *IsayasTadesse,2016. Commercial Solid Waste Generation and Composition Analysis: Arada Sub city, Addis Ababa.*
- *Fathima et al., 2011. Partnerships for Solid Waste Management in Developing Countries: Linking Theories to Realities a Water and Sanitation Program-South Asia, Bangladesh.*
- *IPPC, 2013. Municipal Waste Management in Namibia: The Windhoek Case Study. [pdf] Universidad Azteca. Available at: http://www.the-eis.*
- *UNIDO: UNITED INDUSTRIAL DEVELOPMENT ORGANIZATION, Introduction to treatment of tannery effluents, Vienna. 2011.*
- *Municipal Solid Waste Composition Determination Supporting the Integrated Solid Waste Management System in the Island of Crete, Greece. Ozgunay et al., 2017.*
- *Kanagaraj et al, 2006. Sustainability in Municipal Solid Waste Management in Bameda and Yaounde, Cameroon, University of Adelaide*
- *KIUE, 2003. Trondheim, Norway: Norwegian University of Science and technology department of geography. Available at. European Commission, 2013.*
- *Kanagaraj,Velappan, Babu, &Sadulla, 2016.*
- *Buljan&Bosnic, 2011.*
- *Study of the Impact of the main Policies and Environment Protections Measures in Africa's Leather Industry, UNIDO. Food and Agricultural Organization of the United Nations, FAO, 2010:*
- *World statistical Compendium for Raw Hidesandskins,Leather and Leather Footwear 1990-2009,Rome,Italy. Foster-Carneiro, T.Perez, M.Romero, 2000:*
- *Influence of total solid and inoculums contents on performance of anaerobic reactors treating food waste, Faculty of Sea Science and Environmental Sciences, Cadiz, Spain. Francesco Fantozzi,Cinziaburatti:*

- *Biogas Production from different Substrates in an Experimental Continuously stirred Tank Reactor anaerobic digester. Journal of Bioresource technology 100(2009) 5783-5789. G.Boshoff, J.Duncan, P.D.Rose, March, 2004:*
- *Environmental Management Guideline for Leather Tanning and Finishing Industry, Thailand. Kanagaraj,Velappan, Babu, &Sadulla, 2016.*
- *Hansen, J.Ruedy, R., Sato, and Lo,K.2006:GISS Surface Temperature Analysis.Global Temperature Trends: 2005 Summation.NASA Goddard Institute for Space Studies and Columbia University Earth Institute .*
- *New York. Hilton, B.L.andOlesziewicz, J.A., 1998: Sulfide induced inhibition of anaerobic digestion, Journal of Environmental engeenring. Thorstensen, 1993.*
- *Global Warming: The complete Briefing.3rd edition .Cambridge: Cambridge University Press. International Energy Agency (IEA), 2000:*
- *Energy Sector Methane Recovery and Use. International Emission Trading Association (IETA), 2006: State and Trends of the carbon Market 2006.Carbon Finance Unit, Washington DC: Domestic Biogas Compact cource,technology and Mass-Dissemination experience from Asia,University of Oldenburg. J.Buljan, G.Reich, J.Ludvik, Augest, 2000: Mass balance in Leather processing,*
  - *United Nations Industrial Development organization (UNIDO) - US/RAS/92/120. Jenangi Luke, Producing Methane Gas from Effluent, Department of Agricultural Production, Adelaide University. Page | 77 J.H Sharphouses, 1995:*
  - *Leather technician's handbook, Publisher: leather product's association (LPA), 75th anniversary edition, Page: 76-135.*
  - *J Kanagaraj,KCVelappan,NK Chandra Babu and S Sadulla,April,2016:Solid Wastes Generation in the Leather Industry and its utilization for cleaner Environment,*
  - *Dry Continuous Anaerobic Digestion of Municipal Solid Waste in thermophlic Condition, Asian Institute of technology, School of Environment, Thailand. Leather Industry Development Institute (LIDI) and United Nation Development Program (UNDP), July, 2010:*
  - *Carbon trading in China, A china environmental health project research, China. M.Bosnic, J.Buljan, Augst, 2000:*
  - *Kanagaraj,Velappan, Babu, &Sadulla, 2016.*

- *Pollutants in Tannery Effluents, United Nations industrial development Organization (UNIDO) - US/RAS/92/120. Meta-Alvarez, J., 2002:*
- *Fundamnetals of the Anaerobic Digestion process, in Page | 78 Biomethanizaation of the organic fraction of Municipal solidwaste, Amesterdam, IWA Publishing Company.*
- *Ministry of Agriculture & Rural Development of Ethiopia (MoARD), November, 2007: Livestock Development Master Plan Study, Addis Ababa, Ethiopia.*
- *Willis,MartijnWilder,Paul Curnow,2006:The Clean Development Mechanism (CDM): Special Considerations for renewable Energy Projects.*
- *Renewable Energy & Energy Efficiency project. National Meteorological Services Agency (NMSA), June, 2001,*
- *Converting Tannery waste to Energy,BLC Leather Technology Centre, Leather Trade House,Kings Park Road,MoultonPark,Northhampton,UK.*
- *Kanagaraj, Velappan, Babu, &Sadulla, 2016): Producing energy and Fertilizer from organic municipal Solid waste.*
- *Depatremnt of Biological systems Engenering,WSU.Z.Song,C.J.Williams and R.G.J.Edyvean,January,2001:, University of Sheffield,UK. European Commission, 2013. Buljan&Bosnic, 2011.*

Appendix B

ST. MARRY UNIVERSITY

SCHOOL OF POST GRADUATE STUDIES

MASTEROFBUSINESSADMINISTRATION

Dear Respondent

This Questioner is made to you to undertake a research for the partial fulfillment of the award of Master of Business Administration at **ST MARRY UNIVERSITY.**

. Here below, there is a questionnaire on waste management practice and challenges (A Case of **NALF**. I would be grateful if you kindly take a few minutes of your time to fill out this questionnaire to putting your personal experience with regard to the issue. Your willingness and cooperation in giving genuine information is well appreciated and the information you provide will be used for academies purpose and will be kept in strict confidentiality. Therefore, you are kindly requested to give your response to each questions after you have read carefully, please complete each part of the questionnaire with atmost commitment, care and honesty.

Thank you in advance!

1. **Questioner for Waste Management and practice on NALF**

Demographic Information

1.1. Your Gender

Male ☐ Female ☐

1.2. Your service year in NALF

☐ Less than one year ☐ 1-5 Years ☐ 6-10 Years

☐ 11-20 Years ☐ above 20 Years

1.3. Your Current Position_____

1.4. Number of years staying on your current position

☐ Less than one year ☐ 1-5 Years ☐ 6 6-10 Years

☐ 11-20 Years ☐ above 20 Years

2. Questions for Waste Management and practice on NALF

You are kindly requested to place mark **X** or on the following alternatives in front of each Questions.

- ❖ Strongly Disagree (1)
- ❖ Disagree(2)
- ❖ Neutral(3)
- ❖ Agree(4)
- ❖ Strongly Agree(5)

S.No	***What are the major sources of wastes at NALF?**	1	2	3	4	5
2.1.	There is high molasses silage at NALF.					
2.2.	There is a high extracted waste from fermentation which is silage at NALF.					
2.3.	There is a high extracted waste from Distillery which is silage at NALF.					
2.4.	I have observed always wastages CIP (clean in Place) of Battles and others					
2.5.	I have observed always solid wastes breakage of battles, metal closure and different type of labeling wastages at NALF.					

Additional Suggestions:-

S.No	*** How do you Evaluate level of existing waste management practice at NALF?**	1	2	3	4	5
1.1.	There is good waste management practice at NALF.					
1.2.	I am very happy with the waste management practice at NALF					
1.3.	NALF recover wastes.					
1.4.	NALF reuses wastes.					
1.5.	The residents are suffering from pollution discharged from NALF.					
1.6.	NALF recycles wastes.					
1.7.	There is modern effluent treatment plant in the NALF.					
1.8.	The NALF. Discharges waste directly to river.					
1.9.	The NALF. has got enough lorries to discharge waste					
1.10.	There is bad smell in the NALF.					
1.11.	NALF company gets benefit from waste management financially.					
1.12.	The NALF disposes wastes untreated to the river nearby.					
1.13.	NALF has complained of pollution community of Mekenisa and Sebeta?					
1.14.	Employees are happy at organization on waste management.					

Additional Suggestions:-

S.No	*** What are the existing wastes management challenges at NALF?**	1	2	3	4	5
1.1.	There are number of challenges during waste management of NALF.					
1.2.	There are economic challenges for waste management practice at NALF.					
1.3.	There are technological challenges for waste management practice at NALF.					
1.4.	There is commitment problem for waste management practice by top managers.					
1.5.	There is a governmental challenge for waste management practice.					
1.6.	The country rules and regulations of waste management are not exercised.					
1.7.	I consider that waste management practice appropriate to keep me motivated for working.					
1.8.	I believe that budget for waste management is wastage.					
1.9.	Media has raised my awareness about waste management.					

Additional Suggestions:-

S.No	**4. What do you suggest a waste management method for the waste at NALF?**	1	2	3	4	5
1.1.	The NALF recover wastes.					
1.2.	The NALF reuses wastes.					
1.3.	NALF recycles wastes					
1.4.	NALF directly discharges wastage to the Environment.					
1.5.	There is modern effluent treatment plant at NALF.					
1.6.	NALF use any purification method.					
1.7.	Enough lorries to discharge wastes.					

Additional Suggestions:-

Appendix C

ST. MARRY UNIVERSITY

SCHOOL OF POST GRADUATE STUDIES

MASTER OF BUSINESS ADMINISTRATION

Dear Respondent

This interview is made to you to undertake a research for the partial fulfillment of the award of Master of Business Administration at **ST MARRY UNIVERSITY.**

. Here below, there is a questionnaire on waste management practice and challenges (A Case of **NALF**. I would be grateful if you kindly take a few minutes of your time to fill out this questionnaire to putting your personal experience with regard to the issue. Your willingness and cooperation in giving genuine information is well appreciated and the information you provide will be used for academies purpose and will be kept in strict confidentiality. Therefore, you are kindly requested to give your response to each questions after you have read carefully, please complete each part of the questionnaire with at most commitment, care and honesty.

Thank you in advance!

Interview Questions

1. What are the major sources of wastes at NALF?
2. How do you evaluate the level of existing waste management practice at NALF?
3. What are the existing wastes management challenges at NALF?
4. What are the impacts of wastes in NALF on the environment?
5. What method is the existing wastes management systems used by NAFL**?**
6. What is the suitable waste management practice is advisable for the waste at NALF?
7. What is NALF daily production performance?
8. How much budget is needed to build effluent plant treatment?
9. Does NALF waste treated properly?
10. What types of effluent treatment plant, primary, secondary, tertiary available at NALF?
11. How much the total budget does NALF spending to waste management per year?
12. Please identify some of the main problems with the current waste management system?
13. How much kilogram or litter waste does your factory discharge roughly?
14. How do you evaluate waste management of ALF from your customers, suppliers, community of NALF point of view?

Thanks for Your Time!