



MADDA WOLABU UNIVERSITY
COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCES
DEPARTMENT OF ENVIRONMENTAL SCIENCE

ASSESSMENT OF ENVIRONMENTAL AND PUBLIC HEALTH IMPACTS
ASSOCIATED WITH THE LIQUID WASTE DISPOSAL PRACTICES FROM ELFORA
MELGE FARM AND AGRO PROCESSING FACTORY
IN WONDO BUSSA KEBELE, OROMIA REGION

MSC THESIS

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JUNE 2025
BALE ROBE, ETHIOPIA

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MELGE FARM AND AGRO PROCESSING FACTORY
IN WONDO BUSSA KEBELE, OROMIA REGION**

**By
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**A THESIS IS SUBMITTED TO MADDA WOLABU UNIVERSITY IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF MASTER IN ENVIRONMENTAL SCIENCE
(SPECIALIZATION IN ENVIRONMENTAL POLLUTION AND SANITATION**

ADVISOR: SHETA ALEMU (D/R)

**JUNE 2025
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A Thesis Submitted to the College of Natural and Computational Science, Department of Environmental Science for Partially Fulfillment of the Degree of Master Science, In

Environmental Pollution And Sanitation done by: **Belachew Dafursa Tumbula**

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As members of the board of examiners of the M.Sc. thesis open defense examination, we certify that we have read and evaluated the thesis prepared by **Belachew Dafursa Tumbula** and examined the candidate. We recommended that the thesis be accepted as fulfilling the thesis requirement for the Degree of Master of Science in Environmental Science (Specialization in Environmental Pollution and Sanitation).

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Final approval and acceptance of thesis is contingent up on the submission of its final copy to the Council of Graduate Studies (CGS) through the candidate's department or school graduate committee (DGC or SGC).

DECLARATION

First, I declare that thesis entitled “**Assessment of environmental and public health impacts associated with the liquid waste disposal practices from Elfora Melge farm and Agro processing factory in Wondo Bussa Kebele, Oromia Region**” is my own work and that sources of materials used have been dully acknowledged. This thesis has been submitted in partial fulfillment of the requirement for MSc Degree at Madda Wolabu University and is deposited at the library. I seriously declare that this is not submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

Name: **Belachew Dafursa**

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Signature: _____

DEDICATION

I dedicate this thesis manuscript to my wife Hamelmal Mesafint and family members as well as friends for nursing me with affection and love and for their dedicated partnership in the success of my life.

STATEMENT OF THE AUTHOR

This paper is my original work and I certify that all sources of information including tables and figures are clearly acknowledged in the text at the place where it appears.

Signed.....

Date.....

BIOGRAPHICAL SKETCH

Belachew Dafursa is Teacher of in Sidama Region Wondo Genet general secondary school where I have been employed since 2003. He is responsible for providing technical analysis of existing and emerging teaching physics. My birthplace is in Wondo genet Busa kebele. My professional work experience is 16. My nationality is Ethiopian and my marital status is married. My physical condition is normal. Certification in Degree in the field of study in physics duration of stays from 2005-2010 E.C in Dilla University. Sidamic with excellent command of speaking and writing. Amharic with excellent command of speaking and writing. English with excellent command of speaking and writing. Computer literacy in introduction to computer programming and basic computer skill.

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LIST OF ABBREVIATIONS AND ACRONYMS

A.A	Addis Ababa
BOD	Biological Oxygen Demand
Cd	Cadmium
CFCs	Chlorofluorocarbon
Co	Carbon monoxide
CO₂	Carbon dioxide
COD	Chemical Oxygen Demand
COPD	Chronic Obstructive Pulmonary Disease
Cr	Chromium
CSA	Community-Supported Agriculture
DAILY	Disability Adjusted Life Year
E.C	Ethiopian Calendar
E.G	Example
EDF	Ethiopian Defense Forces
EH	Environmental Health
EHIA	Environmental Health Impact Assessment
EIA	Environmental Impact Assessment
FGD	Focus Group Discussion
GBD	Global Burden of Diseases
Hg	Mercury
ISRA	Investigate Survey research Approach
Ni	Nickel
PH	Potential of hydrogen
PO₄	Phosphate
PYLL	Potential Year of Life Lost
SPSS	Statistical Package for Social Science
TH	Total hardness
TTS	Total Suspended Solid
WHO	World Health Organization

ABSTRACT

Liquid waste disposal practice, which is a consequence of day -to- day activity of human kinds, needs to be managed properly. Bussa Kebele faces problems associated with poor practices waste disposal from Elfora Melge farm and Agro processing factory. The purpose of this study was to assess environmental and public health impacts associated with the liquid waste disposal practices from Elfora Melge farm and Agro processing factory in Wondo Bussa Kebele, Oromia Region. To serve this purpose investigative survey research design was employed both quantitative and qualitative methods. For the study Bussa Kebele was selected by using purposive sampling, while 182 households were selected by using simple random sampling techniques. Additionally, 2 healthy extension workers and 2 kebele health professionals were included through purposive sampling. Questionnaire and experimental physicochemical Analysis were used as the main tools of data collection. Key informants were used to substantiate the data gathered through questionnaires. The data was collected by observation, interviewing factory employees, and interviewing residents. Data were analyzed using descriptive and inferential statistics temperature, pH, electric conductivity, dissolved oxygen, total suspended solids, total dissolved solids, biological oxygen demand, and chemical oxygen demand to determine the impact of the poor liquid waste handling practice of the stream water in the area. The major problems that hinder household liquid waste disposal in the kebele lack of institutional coordination, insufficient and unskilled man power, very low financial capacity, weak enforcement of rules and regulations, socio-cultural factors and lack of awareness among the community. The poor liquid waste handling practice of residents, the poor solid waste handling practice of neighboring households and the poor liquid waste handling practice of factory. It is recommended that establishing a comprehensive monitoring program to periodically assess the environmental and health impacts of liquid waste disposal. This should include measuring water quality parameters in local water bodies and monitoring of potential contaminants that could pose a public health risk.

Keywords: *Factors influencing, liquid waste disposal, sanitary facility, waterborne diseases, Bussa Kebele*

1. INTRODUCTION

1.1. Background of the Study

The word “Environ” is derived from the French verb “Environner,” which means “to surround” or “to encircle.” This is how the term “Environment” is formed. In general, the word “environment” refers to the “natural surroundings” which includes the physical surroundings that are shared by all living things such as air space, water, land, plants and various flora and fauna. The term “environment” refers to the relationship that exists between water, air and land and humans, other living things, plants, microorganisms and property. The fundamental elements of the environment are made up of humans, animals and plants.

Environmental health may be defined as the art and science of controlling physical, chemical and biological factors external to a person and all related factors impacting behavior. It encompasses the assessment and control of those environmental factors that can potentially affect human health environmental health (EH) is a critical component of most government public health programs at national, regional and local level. Environmental health comprises those aspects of human health including quality of life, that are determined by physical, chemical, biological, social and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting, controlling and preventing those factors in the environment that can potentially affect adversely the health of present and future generation. Environmental health is the branch of public health that protects against the effects of environmental hazards that can adversely affect health or the ecological balances essential to human health and environmental quality. Environmental health is the discipline that focuses on the interrelationships between people and their environment promotes human health and wellbeing and fosters a safe and healthful environment (Mitike G, 2016).

Environmental health services are those services which implement environmental health policies through monitoring and control activities. Despite a wide scope of environmental health services in Ethiopia, the service delivery system and level of professionals’ engagement are not studied well. The current status included all institutions which are known to provide environmental health services and it revealed that disease prevention and health promotion.

Environmental health services are the variables of this study which are comprised different services, namely; services regarding environmental problem identification, services regarding

to regular/routine activities, services related to implementation of environmental health policies, standards and planning, environmental health knowledge, skills, innovation, solutions and research. Environmental health services are considered as extracurricular activities and any support are on the will of institute directors and head of programs. You are supposed to perform bulky services without budget, training and appropriate professionals suitable for the service. Even if you perform certain activities after advertising all these obstacles, there is no recognition for the professionals providing the service (Tafere, 2014). The growth of population, production and consumption eventually led to an increase of the industrial and household waste mass. Thus, man himself has created the unfavorable ecological situation, which is now observed all over the globe on all continents and in all regions of the earth. The current global environmental crisis arose naturally as an unintended result of human economic activity and its increasing adverse impact on the natural environment. The current environmental situation shows that human activity, as a rule is carried out in nature without taking into account environmental conditions and the laws of nature existence. This activity is merely the outward manifestation of a person's relationship to the environment that is the manifestation of his ecological culture. Today, the main environmental problems include global warming and the greenhouse effect, the reduction of the ozone layer, pollution of the atmosphere and the oceans and as a result of all this, the gradual reduction and progressive death of representatives of the animals and plant world. All the above-mentioned problems are interrelated since the violation of at least one component implies and leads to an imbalance of another component or the entire ecosystem as a whole (Van, 2017). Environmental quality links to the use of resources and waste disposal. It relates to the effluent systems and waste management, greenhouse gas and particulate matter and poor infrastructure and meager urban planning (Colombani, 2018; Liu, 2015).

Environmental Health Impact Assessment (EHIA) process is a systematic identification and evaluation of potential environmental health effects of proposed project, plans, programs or legislative actions relative to the physical-chemical, biological, cultural and socio-economic components of the total environment. EHIA is a planning and decision-making process to assess and mitigate the negative environmental health impacts of developing and developed projects, plans policies, programmes and legislative actions. Sustainable development is a kind of development that meets the needs of the present without compromising the ability and efficacy

of future generations to meet their own needs. EHIA process can be defined as the systematic study and check of the potential impacts (effects) of proposed projects, plans, programs, policies or legislative actions relative to the physical-chemical, biological, cultural and socio-economic components of the total environmental and social product life cycle. The primary purpose of the EHIA process is to encourage the consideration of the environmental health in the organizations and decision-making process and to arrive at actions that are environment and natural resource health is compatible. The organizational planning and decision-making process should include the integrated considerations of medical, technical or engineering, economic, environmental safety and health. EIA and EHIA processes have been conducted for a nuclear powerplant to consider the safety and health impacts to mitigate psychological health loadings on workers and nearby residents (Gurumurthy, 2016). There were no reports in the literature on the study of some composition of waste water was expected to deliver a base line data on the composition in waste water that discharged from factories. Because the waste matter mentioned above mixed with the other water. Due to this reason, emphasis is given to the determination of the level of pH, total dissolved solid (TDS), chlorine (Cl^-) and selected heavy metals (Cd, Cr, Pb, Zn) composition present in waste water from factories. Therefore, determination of level of some physiochemical parameters and meta composition in the waste water from factories is very important to ensure individuals health status level of metals depending on the reported result under the discussion and recommendation parts by comparing the analyzed parameters with WHO water quality standards. Furthermore, the result of this study may help for regular monitoring and control contamination of water from factories in Wondo Genet Busa Kebele.

1.2. Statement of the Problem

The impact of human activities on the environment has been increasing since the beginning of the industrial revolution and at current it extends to a much great level, at continental and global scale. Emission levels have reached the point where environment related physical effects are witnessed on large proportion (Van der Byl, 2015). In addition, according to (Memichael, 2008) the environmental effects that are related with industrialization in least developed countries remain crucial as they encroach typically on the poor and vulnerable communities. Chemical and heavy metals remain contaminate local foods, urban air pollution brings premature deaths and water borne internal organ pathogens cause for the death of children. In Ethiopia due to population growth and urbanization, industries are hurriedly evolving in different parts of the

country. Although, these industries have social and economic importance still they have environmental influence on local communities. As study conducted by (Slovin, 2017) revealed, human beings have been polluting the environment with their industrial activities. Other study conducted in Addis Ababa by (Menbere, 2019) indicated, the liquid wastes from poorly handled industries such as textile and garment, beverage industries and industrial parks were contributing to the pollution of both water bodies and different parts of the city. On the other hand, according to (Fahir, 2012), there was a poor level of knowledge about the current regulations on liquid waste management among the experts as well as the community. Wondo Busa Kebele is one of small sized town found in Oromia regional state, which hosts the Melga Food Processing Factory reveals this problem (Wondo Genet Woreda Environmental Protection, Forest and Climate Change Authority, 2022). Elfora Melga Farm and Agro Processing Factory was constructed for social and economic development, though this factory is polluting the surrounding environment through liquid waste that it disposes as they are not properly treated. For example, the study woreda Environmental protection Bureau, (2021) investigated that concentration of phosphorus (P) in the sample treated waste water from the food processing factory was 8.5 mg/l which is greater than the national limit that is <5 mg/l. in addition, from the outlet of the communal treatment of food processing factory, dark color waste waters and offensive odor are observed showing the discharge of inadequately treated waste water from the factory. Furthermore, the local communities have been repeatedly complaining of liquid waste pollution from the factory. It is also observed that, this waste water has been mixed with nearby small stream and commonly known as “Bowagnamo Waa” meaning water with bad odor used as source of irrigation water utilized by local farmers to grow vegetables. This might have considerable health impacts on the local community various scholars conducted research in the area of industrial liquid waste pollution dealing with different parameters and they found out that large concentration of Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Suspended Solid (TSS), and PH found in the observed industries (Dadi D, 2017), (L, 2007), (Lo CK, 2012). On the other hand, (F, 1998) conducted research on the metal concentration of some vegetables irrigated with industrial liquid waste at Akaki, and the research found out that some metals such as Cd, Cr, Cu, Hg, Ni and Zn in potato and Cr in onion and red beet was above the maximum limit with less considering liquid waste management practices and the contribution of communal treatment plant. Therefore, this study

focuses on filling some of these gaps such as environmental and public health impacts associated with the liquid waste disposal practices in case of Wondo Genet Elfora Melge Farm and Agro Processing Factory.

1.3. Basic Research Questions

1. What are the major environmental and public health impacts associated with the liquid waste disposal practices in case of Wondo Elfora Melge Farm and Agro Processing Factory?
2. What are the impacts of liquid waste on local water bodies by measuring parameters in a case of Wondo Elfora Melge Farm and Agro Food Processing Factory?
3. What are the potential public health risks associated with the discharged liquid waste from the Wondo Elfora Melge Farm and Agro Processing Factory?

1.4. Objectives of the Study

1.4.1. General Objective

To assess the environmental and public impacts associated with the liquid waste disposal practices of the Wondo Elfora Melge Farm and Agro Processing Factory.

1.4.2. Specific Objectives

The specific objectives of this study were:

- ❖ To analyze the chemical and biological composition of liquid waste discharged from the Wondo Elfora Melge Farm and Agro Processing Factory.
- ❖ To assess the impact of liquid waste on local water bodies (by measuring parameters such as PH, dissolved oxygen, biochemical oxygen demand (BOD), Chemical Oxygen Demand (COD), nutrient levels (nitrogen and phosphorus), heavy metal concentrations and microbial contamination.
- ❖ To identify potential public health risks associated with the discharged liquid wastes from the Wondo Genet Elfora Melge Farm and Agro Processing Factory.

1.5. Significance of the Study

The environment is crucial to both healthy living and the continuation of life on earth. Many living things call earth, home and we are all reliant on it for basic necessities like food, water, and air. As a result, it is critical that each and every person preserve and safeguard the environment. The assessment of the environmental and public health impacts associated with

the liquid waste disposal practices of the Wondo Genet Melge Farm and Agro Processing Factory would be the main focus of the study. Thus, the purpose of this study was to precisely identify the environmental health impact of the liquid waste as well as to offer suggestion for such practices.

The study's findings would assist the factory in reviewing its policies and practices and in taking the necessary steps to address the effects on environmental health. This study would also be helpful for other institutions to reconsider their environmental health impact of the liquid waste and the to understand the implications of environmental challenges such as climate change, loss of biodiversity, ozone layer depletion, destruction of habitats, depleting ground water supplies, introduction of alien species, environmental pollution, solid waste disposal, storm water and sewage disposal. In addition to this, the study would serve as reference for other researchers who are interested in conducting research on the same topic. Moreover, this study would benefit the researcher by making him proud of his investigation and mentally satisfied with the findings of this study.

1.6. Scope of the Study

For the sake of its manageability and scarcity of resources, this study would conceptually focus only on the environmental and public health impacts associated with the liquid waste disposal practices in the case of the Wondo Elfora Melge Farm and Agro Processing factory. The study was delimited to Wondo Busa Kebele that found in Oromia Region, Ethiopia. The researcher believes it was better if the study covers all parameters and assess large number of heavy metals concentration in Wondo Busa on water quality parameters such as pH, Chloride, total dissolved solid (TDS), Electrical Conductivity (EC), total hardness (TH) and selected heavy metals such as cadmium chromium, lead and zinc content. The study was conducted winter time and summer due to the factors such as which can affect the physical, chemical and biological behavior. Therefore, geographically, the study would be limited to the Wondo Elfora Melge Farm and Agro Processing factory in Oromia Regional state, 2017 E.C.

1.7. Limitation of the Research

The major limitation encountered in the study was that some of the research participants were busy and had no enough time to respond questionnaire and interview. Due to this, 34 (15.7%) of respondent's response were rejected, because of their response were incomplete. The

shortage of well-organized and documented data and lack of references at selected kebele, lacks of enough Internet access and lack of transportation to go to each kebele were the main challenges/limitations for the research work. Thus, researcher attempted to arrange convenient time and contacted study participants in weekend days and calling on telephone. In addition, all these challenges, the researcher have tried to critically analyze the available data to answer questions raised in the study.

1.8. Organization of the Study

This study contains five chapters. The first chapter deals with an introduction to the study, such as the background of the study, statement of the problem, objectives of the study, basic research questions, significance of the study, scope of the study and organization of the study. The second chapter contains a literature review on understanding environmental health impacts of the liquid waste. The third chapter deals with the methodology parts of the study, like a description of the study area, research design, data type and data sources, population of the study, sample size of the study, sampling techniques, data collecting instruments and data analysis and interpretation will be employed. Chapter four of this study deals with the expected outcomes, dissemination, ethical consideration, environmental considerations, gender consideration and the last chapter deals with work plan and budget breakdown, reference and finally appendix of the study.

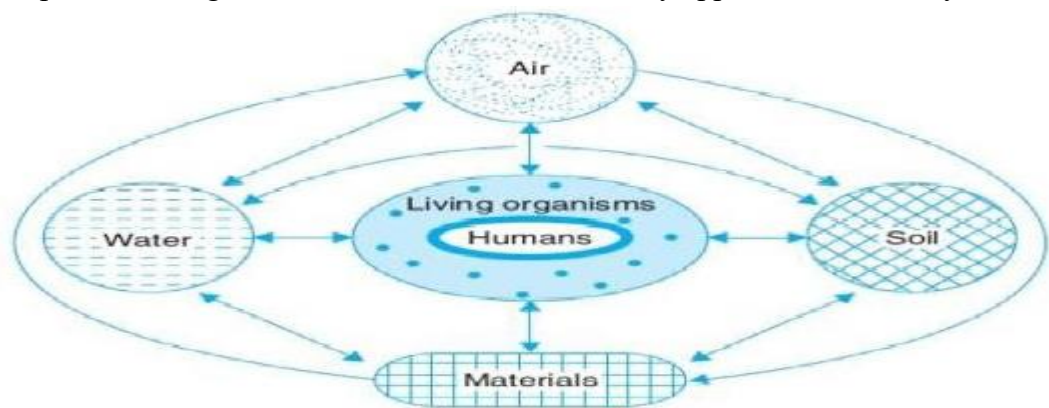


Figure 2.1: The concept of Environment (Kumar, 2018).

2. LITERATURE REVIEW

2.1. Introduction

Environment refers to surroundings in which living things and non-living things exist. Environment belongs to all the living things. It plays a major role in the healthy living of human beings. environment includes air, water, land, living organisms and material surrounding us. Since environment is a combination of physical and biological factors, it contains both living and non-living components. Everyone may be affected by environmental issues like global warming, ozone layer depletion, energy resources, acid rain, nuclear accidents, loss of global biodiversity and so on. The environment sustains life. Man needs to know the importance of environment and help keep the environment as healthy and productive as much as possible. Environmentalists around the world are constantly seeking sustainable solutions to restore a sustainable environment (Kumar, 2018).

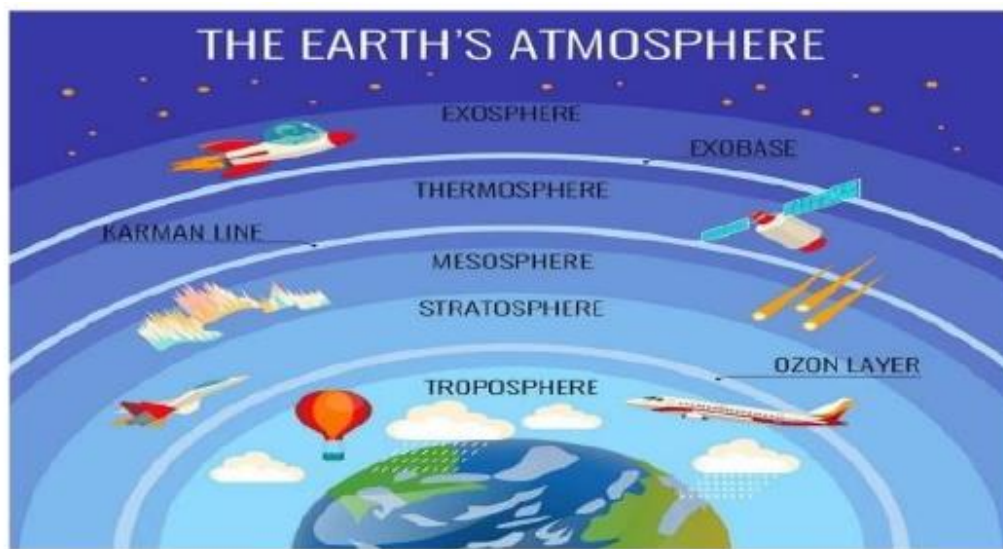


Figure 2.2: Segments of the Environment (Asadul, 2018).

Environmental health is a combination of two broad dimensions, that is, environment and health. The environment encompasses everything that surrounds us while health is a result of influence of environmental factors on us. Everything that surrounds us be it air, water, soil etc. have influence on our physical, mental and social health. Hence, we cannot overlook the human health problems without understanding environment (Grover, 2020). Industrial pollution is considered an important factor to contaminate the environment. It results in environmental degradation and imposes heavy costs on society as well as on human health and safety textile, cement, glass, plastic, sugar, tanning, petroleum are major polluting industries.

Little or no attention is paid to this grave issue of industrial pollution. There is no systematic approach used by many industrial sectors for proper disposal and drainage of their harmful effluent. The industrial sector should be held accountable for their responsibilities towards proper management of waste effluent, as it contributes to about 50% of the environment pollution. It creates great social costs in a developing country like Ethiopia. Currently there is no effective management and controlled practices for pollution prevention and control but authorities have started to pay attention in this regard. Pollution control has become the primary concern of the environment today. The objective of this paper is to explore the impact of environmental pollution on the environment and society. To develop an understanding of environmental degradation, the study discusses the various types of effluents that impact the environment adversely. Recommendations for alternative measures that can be helpful for controlling pollution (Asadul, 2018).

2.2. Environmental Health

Environmental health (Hygiene) is the basic biomedical preventive branch aimed to promote and protect health, taking into account the interactions between the environmental biological, physical, chemical and social factors and the human organism and the impacts of the environment on human health. It is concerned with the control of all biological, physical and chemical processes, influences and factors that exercise or may exercise, by direct or indirect means, a significant effect on the physical and mental health and social well-being of man and society. It covers the quality of air, water, soil, climate, food and nutrition, working conditions and physical and mental strains, life style, habits, abuses, housing, waste disposal, knowledge of disease incidence and prevention. Hygiene is the major discipline of public health, defined as a multidisciplinary field that combines and applies techniques from both social and natural sciences to assess the health state of a population, to promote human health and to prevent diseases. Hygiene bears the name of the Goddess of health – the Greek hygiene who is presented as a beautiful woman, whose symbol is a snake drinking water from a bowl the goddess holds in her hand.

Environmental health (environmental hygiene) comprises the same aspects of human health and disease that are determined by factors in the environment; refers to the theory and practice of assessing and controlling factors in the environment that can potentially affect health. Environmental health includes both the direct harmful effects of chemicals and biological

agents and the effects (often indirect) on health and well-being of the broad physical, psychological, social and aesthetic environment. Environmental health standards are established based on the quantitative relationships between the intensity, frequency and duration of exposure to various environmental influences and the risk or magnitude of undesirable effect on man and his environment. These relationships are derived from toxicological, epidemiological and environmental studies. Environmental health standards are “acceptable” or “permissible” limits of concentration (or of other index of the intensity of exposure) established to protect a defined population from the undesirable effects of a specified exposure to one or several environmental hazards (e.g. the work environment, ambient air, water and xenobiotics in food). Such limits are set for pollutants taken up by an organism or a population. This is sometimes called a “primary protection standard”. It is the accepted maximum level of a pollutant (or its indicator) in the target or some part of thereof, or an accepted maximum intake of a pollutant or nuisance into the target and specific circumstances. Environmental hazards are all kinds of environmental factors or exposures that adversely affect or the ecological balance necessary to human health, safety and well-being. Environmental factors involve characteristics of the occupational or personal environmental such as work safety and housing conditions, but also the global environment such as water, air, soil and food. Environmental hazard is for example water contaminants, toxic chemicals, wastes, air pollution, disease transmitters and radiation. The next basic terms in connection with environmental hygiene are norms, criteria and standards. Norm is the most general term encompassing expressions of desiderata such as goals, objectives, policies and standards. Criteria are measurable components (or tests) of a standard that permit determinations to be made of whether or in what respects a standard has been met (e.g. a water quality standard has as its component criteria such as measurements of pH, chlorine content, etc.). standard is either an explicit statement of conditions to be fulfilled in an operating process (e.g. personal cleanliness of food handlers) or as a characteristic of an end-state (e.g. water fit for drinking) (Prof. L’udmila Ševčíková, 2015)

ENVIRONMENTAL HEALTH



Figure 2.3. Environmental Health (L'udmila Ševčíková, 2015)

2.3. Why is Environmental Health is Important?

The health of environment is important because it relates to us, that is health of human beings. It doesn't exist in isolation; rather, very strong inter-relationships can be scientifically observed and proved between the two. The health impacts from the environment can be both short term/acute or long term/chronic. The acute conditions may include cold or flu, oil spill, food poisoning or heart attack. These are relatively short lived and have sudden onset. On the other hand, chronic conditions develop or worsen over a long period of time. The cause of chronic conditions is can be more than one so it is difficult to understand the real cause, for instance, asthma, cancer and diabetes. Somebody, who is a non-smoker, may be continuously exposed to air pollution on daily basis as he/she live near a factory or a traffic junction and therefore may face chronic respiratory diseases. In reality, it is not one environmental factor responsible for diseases.

There may be other factors contributing like indoor pollution, housing conditions, living conditions, life style, diet, genetics and many others (Park, 2015).

2.4. Determinants of Health

Broadly, physical, social and individual factors influence human health. Physical may include factors like air, water, soil, food availability, pollution, noise etc. social includes health care facilities, education, race, income etc. and individual includes behaviors and genetics. Other

than these government policies, subsidies, programmes for betterment of environment and accessibility to health services are necessary. There are chemicals, toxins, radiation, disease causing microorganisms and plants, pesticides and heavy metals in our physical environment that can cause damage to human health. these environmental substances related to air affect the lungs, food affects the digestive system, water and soil related substances affect digestive system and skin. All these are released by human activities of agriculture, transportation and industrialization. Health conditions that may be linked to environment are cancers of liver, bladder, lungs; asthma and respiratory diseases; diseases of the nervous system; Parkinson's diseases Alzheimer's diseases; autism, birth effects and developmental disabilities. These illnesses are not solely caused due to environmental conditions, rather may be aggravated due to them. Various population characteristics like age, gender, race and ethnicity and socio-economic environment may also influence human health (Patel, 2015).

2.5. Main causes of Environmental Pollution

The problem of environmental pollution, we face today, is a complex consequence of forces connected with various interrelated factors. There are clearly a number of divergent and conflicting views of what could be the basic factors underlying the environmental crisis. No single cause can be considered as the root cause of environmental impairment. However, the following causes could be pointed out as the generally underlying factors though each of these too could be operating simultaneously and their balance may vary from place to place and through time. Modern thinkers consider that growth of population is the root cause for many human problems. This observation also applies to environmental degradation. Increase in the population will have a multiplier effect requiring proportionate increase in all requirements necessary for the existence of human beings. population growth requires abnormal exploitation of natural resources to provide day-to-day essential requirements of life. It results in migration of people and growth of urban areas, thereby inviting new problems of health, ecology and human sustenance. The affluence (material aspects of per capita consumption of goods and resources) is an important factor in man-resource-environment relationship. It is the increasing per capita demand of rich which is absorbing the growth in output of goods and services in the developed and developing countries and cause misuse or overuse and pollution of resources for the affluence unmatched to the necessary resource consumption and not motivated by human requirements produce tendency to waste matter and energy. Surprisingly, affluence factor

though, having a great impact on environment is seldom talked about. On the other hand, poor and the poverty often get blamed for the destruction of environment. The notion that poverty or the poor destroy the environment most is but partially true. Deforestation gives birth to several problems encompassing environmental degradation through accelerated rate of soil erosion, increase in the sediment load of the rivers, siltation of reservoirs and riverbeds, increase in the frequency and dimension of floods and droughts, changes in the pattern of distribution of precipitation, intensification of greenhouse effects increase in the destructive force of the atmospheric storms etc. economic loss through damages of agricultural crops due to increased incidence of floods and droughts, decrease in agricultural production of loss of fertile top soils, decrease in the supply of raw materials to the factories and building matters etc. thus deforestation cause a chain effect which adversely affects the natural environment.

Conversion of forests land into agricultural farms on sloppy ground accelerates rate of soil erosion. Increased in agricultural land at the cost of destruction old forest and consequent soil erosion, substantial increase in the productivity of land through the practice of intensive cultivation, increased use of machines and modern scientific techniques, application of chemical fertilizers, pesticides, insecticides and herbicides, increase in the frequency and area of watering of agricultural fields. All these processes and measures of increased agricultural development cause several serious environmental problems. It appears that the root cause of all these environmental problems arising out of agricultural development is the increase of human population at alarming rate. So, the for most step to be taken is to stop population be maintained. Rapid industrial development has given economic prosperity to human society. It has also given new dimension to socio-economic structure and has provided material comfort to the people of industrially developed countries but it has also created many folds environmental problems. In fact, the glittering effects of industrialization have affected the mind of the general public that industrialization is now being considered as the parameter of modernity and as a necessary element of socio-economic development of a nation. Rapid rate of industrialization resulted into rapid rate of exploitation of natural resources and increased industrial output. Both the components of industrial development e.g. exploitation of natural resources and industrial production have created several lethal environmental problems and have caused large scale environmental problems and ecological imbalance at global, regional and local levels in a variety of ways. Besides desired production there are numerous undesired outputs from the

factories such as industrial wastes, polluted water, toxic gases, chemical precipitates, aerosol ashes and smokes etc. which pollute air, water, land, soils etc. and thus degrade the environment. The industrialized countries have increased the concentration of pollutants emitted from the factories in the air, water and land to such an extent that they have degraded the environment to the critical limit and have brought the human society on the brink of its destruction. The adverse effects of industrialization may change the overall character of natural system and the chain effects sometimes become suicidal for human society. Majority of the impacts of industrialization are related to pollution and environmental degradation. The release of toxic elements into the environment through the application of chemical fertilizers, pesticides and insecticides (output of chemical industries) changes the food chains and food webs and physical and chemical properties of soils, tanks and lakes into rivers and seas contaminates water and causes several diseases and deaths of organism and thus disturbs ecological balance of aquatic ecosystem. Increasing industrial expansion is responsible for the release of enormous quantities of pollutants e.g. ions of chlorine, sulphate, bicarbonate, nitrate, sodium, magnesium, phosphate, through sewage effluents into the rivers and the lakes and thus for contaminating the water. Release of several gases, smokes, ashes and other aerosols from the chimneys of the factories adversely affects the environment in a number of ways. The burning of hydrocarbon fuels (coal and petroleum) has increased the concentration of CO_2 in the atmosphere and thus has changed the natural gaseous composition of the atmosphere. The increase in the construction of CO_2 content of the atmosphere may change global radiation and heat balance by increasing the level of sensible heat in the atmosphere because CO_2 intensifies the green house effects of the atmosphere as CO_2 allows the solar radiation to pass through the atmosphere and reach the earth's surface but stops the outgoing long wave terrestrial radiation from escaping to the space release of chlorofluorocarbon in the atmosphere causes depletion of ozone layer. Depletion in ozone layer means less absorption of ultraviolet solar rays and thus substantial increase in the temperature at the earth surface. Exodus of population from rural areas to urban center and origin and expansion of new urban centers due to industrial expansion and development are responsible for rapid rate of exploitation of natural resources and several types of environment degradation and pollution in the developed and developing countries. The level of urbanization in the developed countries of the world has already reached its peak. The accumulation of wealth and availability of more economic and job opportunity in the urban centers have resulted

in to the concentration of population in the congested metropolitan areas and thus the formation and growth of big slum areas. In fact, increasing urbanization means increase in the concentration of human population in limited space which results in the increase of buildings, roads and streets, sewage and storm drains, vehicles (motor cars, trucks, buses, motor cycles, etc.) number of factories, urban wastes, aerosols, smokes and dusts, sewage waters etc. which cause several environmental problems. For example, increasing population of the urban centers uses enormous amount of water for various purposes. The used waste water like sewage water, if untreated, pollutes the stream and lakes because the urban effluents are allowed to be drained into them. Urban centers when combined with industrial sectors become more hazardous from the stand point of environmental problems and pollutions. Huge quantity of aerosols and gases is emitted from chimneys of factories and vehicles which form “Dust Domes” over the cities (Appannagari, 2017).

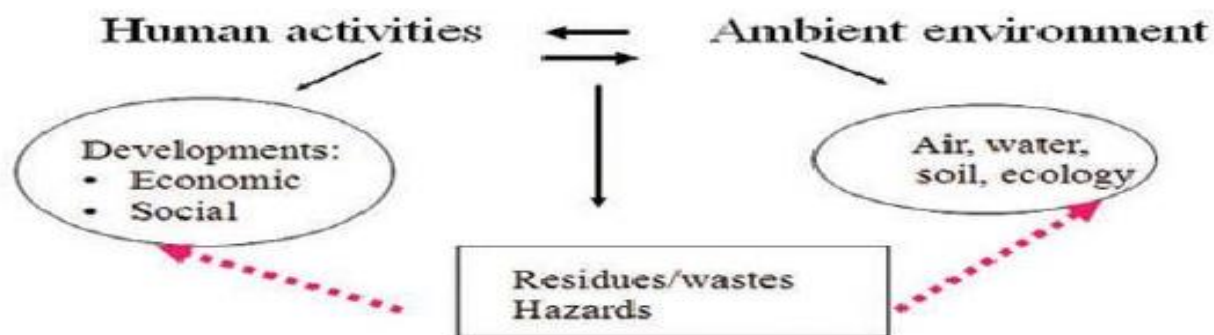


Figure 2.4.: Factories and Environment (Khatir & Ahmed1, 2017)

2.6. Factory and Environment

Modern man and the complexity of his activities, especially in the fields of industry and technology produced substances that are foreign to the natural components. These substances affect the air or water or land or biological components. Macro and microorganisms suffered from either some level of contamination that rose to dangerous pollution. Industrial processes produce liquid, solid and gaseous wastes which have negative effects on the environment and people. Acid rain is an example, it results from emissions of sulfur dioxides and nitrogen oxides from chimneys and exhaust pipe. These wastes are generated either during processing or at the end of production process. At a closer range this atmospheric pollution can also increase respiratory disease liquid wastes when disposed in water bodies without treatment greatly affect the aquatic organism (Roghaia, A.A. 1989). Waste and global issues: there are a number of

aspects associated with waste, which have global implications. These include the effect on the ozone layer from CFCs, which remain in the old refrigeration equipment and the greenhouse gases such as carbon dioxide and methane have been estimated to make a contribution seven to ten times greater than the same volume of carbon dioxide to the greenhouse effect. Rio conference objectives for waste management, as stated in the 1992 Earth Summit Agenda;

- To minimize waste.
- To maximize environmentally sound waste re-use and recycling.
- To promote environmentally sound waste disposal techniques (Khatir&Ahmed1, 2017)

2.7 Environmental Impact of Operations

All three natural environmental components air, land and water are severely affected due to various industrial operations. It has an adverse impact on biotic (humans, animals, plants, microorganisms) and abiotic (air, water, land, soil) components of the environment. Untreated industrial effluents cause serious degradation of the environment. Residential areas in urban cities are also affected badly due to increasing pollution. Because of the harmful impacts of industrial operation, society as well as the economy has to pay heavy costs. It is evident from various reports that industrial effluents account for major portion of environmental degradation. Industrial sectors in various cities of Ethiopia have no governmental assistance for growth and infrastructure to development. These industries are situated within residential cities and use domestic sewage systems for releasing harmful effluents. The important industrial sector includes cloth weaving and processing, garments, iron foundries, glass, plastic, metallurgical products cement and paper pulp; all these are within municipal limits and cause great havoc to cities (S. N. Shah*, 2021).

2.8 Global Burden of Diseases

The effect of environmental degradation and its effect on human health is very difficult to measure as it is not only illness or disease but also loss of productivity, income and expenditure on health care that are important indicators of degrading human health. Efforts to quantify the environmental burden of disease have been spearheaded by Smith, Corvalan & Kjell Strom (1999). Their results provide the basis for estimating the environment's impact on health. As per their results, diarrheal diseases are 8090% attributable to environmental causes, followed by

acute respiratory infections, estimated to be 4060% environmental. Malaria and cancer also contribute substantially to the environmental burden of disease.

The global burden of diseases (GBD) study was started by WHO in 1990 and the latest recorded report was released in 2016 using the 2015 data. The GBD aims to systematically understand, analyze, project and measure the causes and impacts of diseases on human life expectancy. To measure the burden of disease the metric used is called DALY. Ischemic heart disease, neonatal disorders, stroke, lower respiratory infections, diarrhea, road injuries and chronic obstructive pulmonary disease (COPD) accounted for more than 1 million deaths each worldwide 2017. The Disability Adjusted Life Year (DALY) to include equivalent years of “healthy” life lost by virtue of being in states of poor health or disability (Lancet., 2018).

2.9 Effects of Biological, Chemical and Physical Agents in Food Resources on Human Health

Unclean environment has the potential to contaminate food and water that are consumed by human causing wide spread diseases. Environmental cleanliness and maintaining personal hygiene are therefore necessary to reduce food borne diseases. Food borne disease include food-borne in toxication's and food-born infections consumed by human beings, commonly referred to as food poisoning. Use of chemicals to ripen fruits/antibiotic and hormone injections for better yield are in turn consumed and enter into our food cycle. As per the Global Burden of Diseases, food borne diseases are one of the major causes of illness and death. Diarrhea diseases alone are responsible for 3-5 million illnesses and nearly 1.5 million deaths annually (Services, 2017). Contaminated and infected food diseases are spread through various biological causative agents. For instance, Anthrax, Cholera, Dysentery and Typhoid fever by bacteria, Amoebiasis and Clonorchis's by parasites (Services, 2017).

2.10 Conceptual Framework of the Study

Conceptual framework as a model of presentation researcher represents relationship between variables in the study and the relationship diagrammatically (Orodho, 2019). In the model environmental and public health impacts associated with the liquid waste disposal practices is the dependent variable whereas Liquid Waste Disposal Practices, Operational Practices of Elfora Melge Farm, Regulatory Compliance and Environmental Conditions are independent variables.

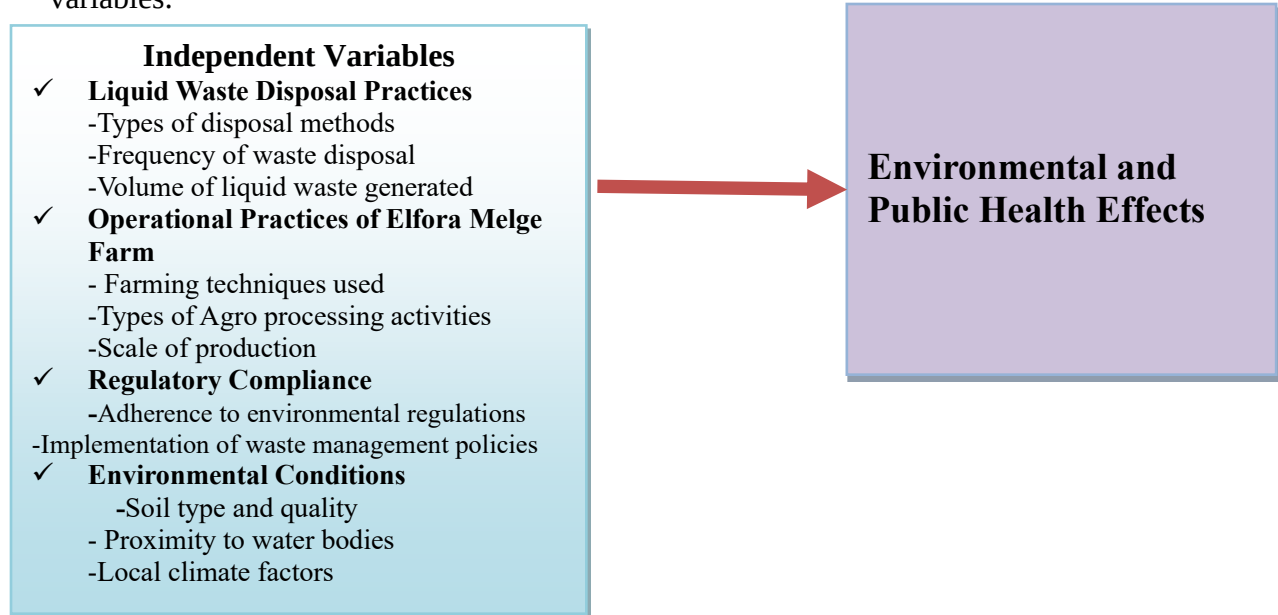


Figure 2.5: Conceptual Framework of the Study

Source: Developed Researcher (2024)

3. METHODOLOGY

Introduction

The study's methodology, which include the population under investigation, the research design, sample size and sampling procedures, data collection tools, data analysis and interpretation, and a description of the study were all included in this section.

3.1 Site of Study Area

Elfora Melge Farm and Agro Processing Factory is found in Wondo Genet woreda Basha Town in Sidama regional state in Ethiopia. It is located in the Great Rift Valley, bordered in the south with Hawassa city administration Tula sub-city, in the north with north-western Oromiya, in the north west with Oromiya region, in the east with Oromiya region, and in Melga Woreda (CSA, 2007). The district has an estimated area of 588km². It comprises 13 rural and 2 urban kebeles, and the center of woreda town is Chuko, which is 24 kilometers from the regional city of Hawassa. The woreda is located at 6°55'00" to 7°04'10" north latitude and 38°31'27" to 38°36'24" east longitude. The factory is known to be topographically located; the altitude mainly falls below 1600 – 2609 m above sea level, and its climate is Dega and Woyna Dega type and located within the rift valley. The total population of woreda is 173,942, of which 89,335 are male and the rest 84,607 are female (Woreda Data Base, 2015E.C.)



Figure 3.1: The Location of Wondo Genet Factory

3.1.1 About the Melgue Food Processing Factory

The main responsibility of Elfora Melge Farm and Agro processing factory is to process food into highest possible yield and the lowest possible cost. The factory is designed to process to mainly Ethiopian Defense Forces (EDF). Due to raw materials, major technical, and

manufacturing defects the factory did not reach the design capacity. The factory has no proper system for waste water disposal. Thus, samples of river water and waste water are to be collected and tested for acidity, concentration of chemicals, and pollution of nearby river due to improper disposal of the food processing factory.

3.2 Research Design

The study design was based on the investigative survey research approach (ISRA) (Chukwu, 2008). Site visits were made to the selected food processing factories. The tasks accomplished during such visits included inspection of processing operations; taking relevant measurements; collection of solid and liquid wastes for laboratory analysis; interviewing relevant staff of the factory and residents of the industrial areas and administering questionnaires to them; and completion of structured questionnaires from available records kept by the factory. Two types of data were sought in each of the factorial project visited. These are qualitative and quantitative in nature and were based on observations, measurements, computations, existing records, information from structured questionnaires, expert opinions, and publications (Chukwu, 2008).

3.3 Data Type and Data Sources

The study was conducted by using both primary and secondary sources of data.

3.3.1. Primary Sources

Primary sources of data are the first-hand information was factual due its immediacy to the data. The primary data of this study was collected through questionnaire that was administrated to employees of Wondo Genet Melgue Food Processing Factory and the interviews that was conducted by the food processing factory.

3.3.2. Secondary Sources

To supplement the primary data, secondary sources of data like current policies and procedures of the factory, published and unpublished documents and other relevant materials. In addition, the researcher generated other relevant data in the factory internal and external settings. Generally, the secondary data was collected from Wondo Genet Melgue Food Processing Factory office various documents such as report, records, manuals, and etc.

3.4. Population of the Study

The population of this study was all employees of Wondo Genet Elfora Melge Farm and Agro Processing Factory who are working directly related to Food Processing in the factory under study. Therefore, this study excluded non clerical, small job titles like guards, runners and securities who was out sourced from other departments.

3.5. Sample Size

In the determination of sample size, the three criteria were very important to gather the required data from sample respondents. These include the level of precision, the level of confidence or risk and the degree of variability in the attributes being measured that enable the researcher to determine appropriate sample size (Miauou & Michener, 1976). Therefore, by considering these issues sample size to collect data through the questionnaire for this N=470 was used Yamane's (1967) formula.

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

Where, n= is the sample size,

N = is total sample frame, and

e= is level of precision (error)

1 = designates the probability of the event occurring.

The confidence level is 95% and $\pm 5\%$ has been employed for the accomplishment of this study.

Hence, N=470 and e= 0.05

$$n = \frac{470}{1+470(0.05)^2} = \underline{\underline{216}}$$

Based on the formula sample size of the study participants or households were 216.

3.6 Sampling Technique

The sampling method from the population was one of probability sampling technique called simple random sampling techniques. The researcher interested in this sampling technique, because, it improves representatives of the sample and every population in the study was have equal chances to select as sample. Therefore, the researcher used simple random sampling for households and purposive sampling was used to select manager of the food processing factory and local leaders.

3.7. Data Collecting Instruments

To collect both primary and secondary data, the researcher used the following data collecting instruments: -

3.7.1. Observation

A direct method of liquid waste disposal and the level of liquid waste management program assessment were carried out by visualizing the area and photos were taken.

Figure 3.2: Sample Investigation



3.7.2. Questionnaire

In this case the questionnaire which was distributed and collected for households of the Food Processing Factory as well as around the population of Wondo Genet Melgue Food processing as primary data collection method.

3.7.3. Interview

The researcher has held key informant interviews using interview guide with the manager of the food processing factory and local leaders to gather qualitative data on those issues under investigation.

3.7.4. Focus group Discussion

Items for focus group discussion was developed by the student researcher for obtaining data and information about waste disposal practice in the food processing factory. Focus group discussion deals with small am micro enterprise.

3.7.5. Document Analysis

The secondary data that were collected from various document such as reports, manuals, policies, procedures of Wondo genet Melge Food Processing Factory of office.

3.8 Validity Test

One of the criteria of measuring instrument must meet is that of validity. According to Anastasia (2000) cited in Kosolo, (2006) validity of an instrument used in the accurate, true and meaningful right. In this study, survey items and the items about the background information was reviewed for by experts in the field. For example, advisors form college of natural and computational sciences of Madda Wolabu University were reviewed that survey questionnaire to insure what the instruments comprehensively cover the domain or items that it purports of cover. Feedback of the instrument also was obtained from the student researcher's advisors. Finally, all accepted comments and feedbacks was including in the final version of the instruments.

3.9 Reliability Test

Reliability of an incitement is the consistency in producing arc liable result. Reliability focused on the degree to which empirical indicator are consistent across two more attempts to measure the theoretical concept. The researcher uses test-retest techniques of assessing the reliability of the instrument this involves administering the same instrument twice to identical respondents not include in the study sample. To ensure its reliability, the researcher pilot tested the entire survey question designed to this study. Ensuring their confidentiality and anonymity, the researcher asked the participants to complete questionnaire and to provide feedback thereafter. Using the data collected for the pilot study, the researcher checked the reliability of the instruments by using the Cronbach's alpha.

Table 3.1: Reliability Statistics: Cronbach's Alpha of the Pilot test

No	Items	Cronbach's Alpha	Number of Items
1	Liquid waste practices, types and components of liquid waste and factors affecting households' liquid waste practices in town households	.9524	16
2	Socio economic- related factors of liquid waste disposal practices	.8612	4
3	Institutional- related factors of liquid waste disposal practices	.9354	4
4	Potential public health risks associated factor affecting liquid waste disposal practices	.7462	9
5	Variables Information	.9244	30
All items		.8839	

3.10. Data Analysis and Interpretation

All data that generated from the respondents of food processing factory was analyzed by using descriptive and inferential statistics both qualitative and quantitative techniques. Quantitative methods include percentages, graphical maps, and tabular form. Qualitative techniques were

cause and effect relationships, and also the data that was collected from direct physical observation or visualization is analyzed by describing the phenomena using personal judgment and supported by photographs.

3.11. Expected Out Comes

This study has tried to assess the impacts of liquid waste on Wondo Genet town in general. In particular, the study was exploring Elfora Melge Farm and Agro processing factory's liquid waste generation rate, liquid waste impacts, and institutional structure and capacity of sanitation. These inquiries were addressed by employing questionnaires, field observation, semi structured and unstructured interview with head and workers of the factory, Focus Group Discussion (FGD) of community members and reviewing published and unpublished documents.

3.11.1. Dissemination

In Oromia Region in Wondo Elfora Melge Farm and Agro processing factory around the Busa Town was improve environmental health impact of the liquid waste of Factory and the population use safe environment. The distribution of information on environmental health impact of the liquid waste in case of Wondo Elfora Melge Farm and Agro processing factory. Giving data to concerned body from the factory.

3.11.2. Ethical Considerations

Taking the severity of the ethical considerations in mind, this study was done with highest importance placed on ethics, confidentiality, and anonymity. In this study, confidentiality and anonymity of the respondents were emphasized to protect their privacy and the dignity (Cohen et al., 2007). Thus, on the cover page of the survey questionnaire, the researcher clearly presented how to protect confidentiality and anonymity of the participants; informing them that involvement in the study is voluntary; the involvement is free of any intended risk; and their names and the names of their kebeles/locality were kept anonymous. The research also was used polite language expression and respect while he was interviewing the respondents with a given type data gathering tool/question. Besides, the other ethical issues that the researcher needs to follow are: not violating rights, not exposing the participant physically or mentally to illegal issue, not invading personal privacy, not duplicating another data to the study in the data collection process from the respondents and not copying of documents for purpose of the study.

3.11.3. Environmental Considerations

Strategies, development guidelines, and land use plans pertaining to green spaces, abandoned and contaminated land, biodiversity and nature conservation, flooding, air and water quality, green design, and climate change are examples of environmental considerations. The environmental protection Act of 1986's guiding principles are taken into account in this statement, which also calls for uniformity in the application of environmental factors within the five themes of people, land, water, air, and sea. Environmental health is the most crucial factor that environmental policy makers take into account. Environmental factors dictate that energy-efficient appliances and equipment should be preferred, as long as the environmentally friendly goods and services have comparable performance qualities and doesn't come at a significantly higher cost or effective delivered cost. The four primary environmental issues that are most likely to have an impact on a business's operations are waste disposal, sustainability.

3.11.4. Gender Considerations

The need for an integrated approach to gender equality and sustainability that on the one hand takes into account the specific needs, preferences and wellbeing of women and on the other hand, ensures their involvement in decision making. Men and women relate to the environment in different ways, and environmental changes have different impacts on their lives. Women play a crucial role in sustaining communities and managing natural resources, but their contributions are often undervalued and neglected. Women creates some of the environmental problems. The environmental affects weather, food, housing and organisms especially in relation to people, animals and other living things. It touches on health, minerals, mining and agriculture. Most African countries are faced with environmental problems. These include air, water and land pollution.

4. RESULTS AND DISCUSSION

4.1 Introduction

This chapter deals with the presenting, analyzing and discussing the data collected through household survey, key informant interview, focus group discussion and observation checklist. The subjects of the study were households and kebele leaders. The focus of this study was to analyze and interpret data on variables of the study namely assessment of environmental and public health impacts associated with the liquid waste disposal practices from the Elfora Melge Farm and Agro Processing Factory in Bussa Kebele.

The quantitative data are presented frequencies, percentages, tables and figures, mean and standard deviation and inferential statistics (bivariate and multivariate) were used to check whether relationship of each variable in thoroughly interpreted and discussed on the basis of key question. Qualitative data were collected through open-ended households survey, key informant interview; field observation and focus group discussion were described as supplementary evidence in addition to the discussions of quantitative data. In this process the first section deals with the general background information of the total population can be presented. The second section deals with the sample representatives; those are as a subject or respondents. And the third section was in light of the basic questions of the research data collected have been analyzed and interpreted.

Questionnaires were distributed to 216 households. Among the distributed questionnaires, 182(84.3%) were correctly filled and returned and the rest 34(15.7%) of household's responses were excluded from analysis for various reasons, such as that housing units were not found, households no longer lived at the original location, and no one was available in the house during data collection.

According to Babbie (1998) 50% response rate is adequate, a 60% response is considered good while a 70% response rate is considered very well. A low reply rate is not acceptable and leads to concerns regarding external validity of the study. Thus, in the following section analysis and interpretation of data were presented in the following sub-sections corresponding to the basic research questions and characteristics of respondents.

4.2 Socio-Demographic Characteristics of the Respondents

Description of the socio-demographic characteristics of the households gives some basic information about sex, age in year, marital status and level of education, religion and family size, income level of households and job description of households.

4.2.1 Characteristics of the Respondents by Sex

As can be seen from figure below among total 182 households that filled the questionnaire, 154(85%) majority of them were male while 28(15%) were female respondents. This showed that in the study area households were dominated by male, however, the data showed that women were more responsible than men in the case of liquid waste disposal practices. The reasons for this choice were that women and men contributed in a different and often unequal way to liquid waste disposal practices at both household and community levels. Women are typically those who manage liquid waste disposal in households because they take care of hygiene.

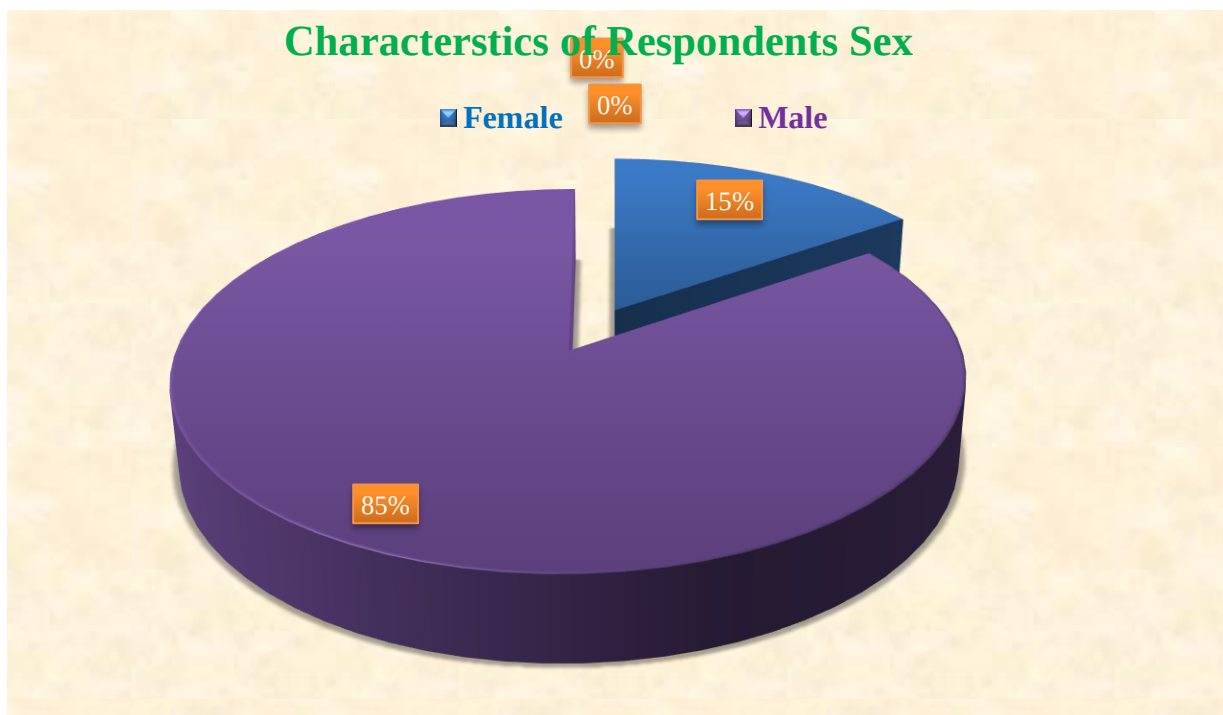


Figure 4.1: Characteristics of Respondents by Sex

4.2.2 Characteristics of the Respondents by Age

Regarding the age distribution of respondents, 60(33%) of households were between 18-25 years of age, 47(25.8%) of households were adult aged people between the ranges of 26-35 years of age, 38(20.9%) of respondents were between 36-45 years of age, 46(12.6%) of

employees were between 46-50 years and the remaining 14(7.7%) of households were included the age 51 and above. However, from the trend it was possible to understand that age of households has impacts on the adoption of improved liquid waste disposal practices. The above data showed that study participants were involved from different age groups and the great majority 150(82.4%) of them were within adult aged group. In addition, the below column showed that active age groups were important for participants be able to bring economic and social gains in their lives through participation in measures to prevent liquid waste disposal practices associated human health risk factors among study area.

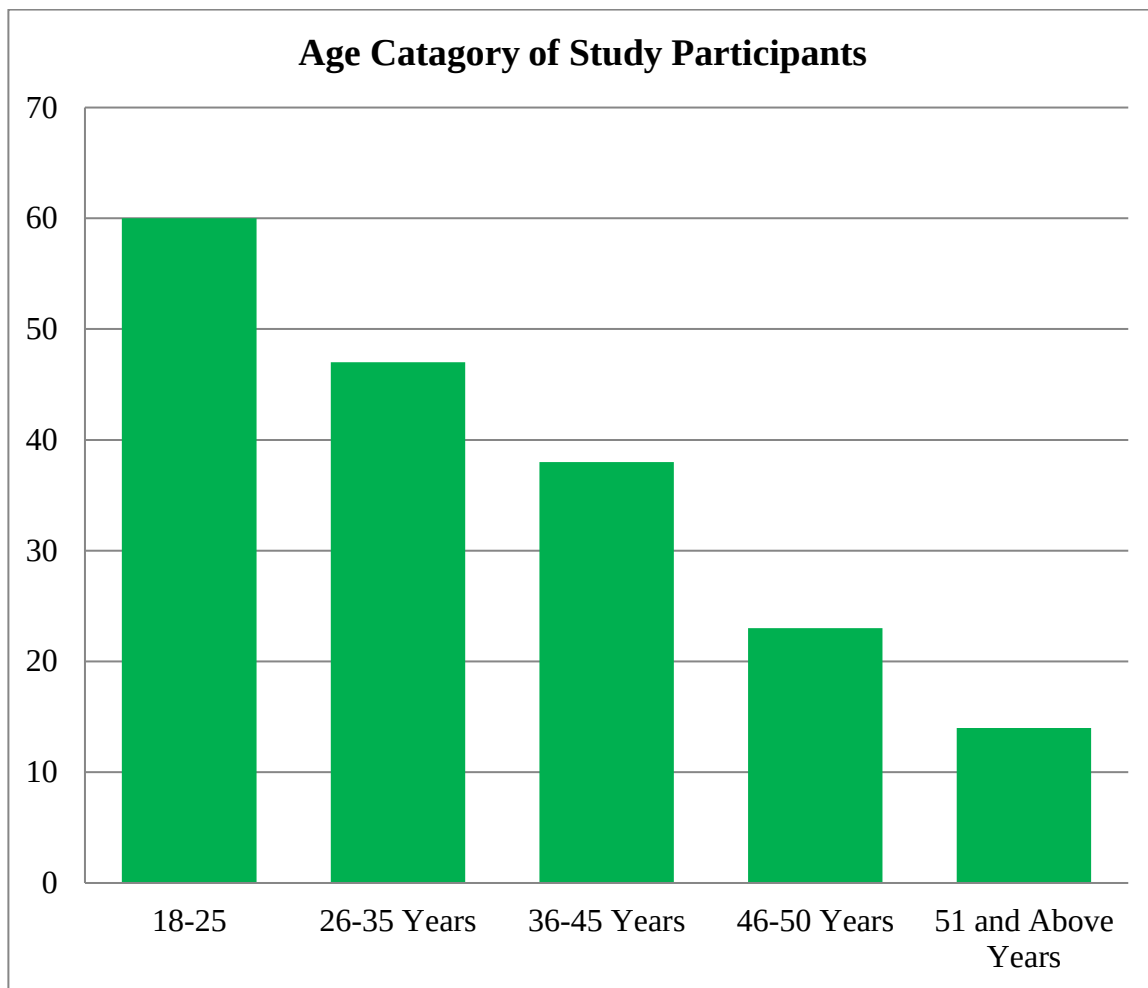


Figure 4.2: Age of the Respondents

4.2.3 Characteristics of the Respondents by Marital Status

As it can be seen in figure 4.3, among respondents about 142(78%) were married, 26(14.3%) of respondents were single and 6(3.3%) of them were windowed. The remaining 8(4.4%) of them were divorced or separated. Married once adopted liquid waste disposal practices better

than the remaining groups. In addition, the above data showed that majority of households were married, from this fact, one can realized that most of married couple were more vulnerable than unmarried in terms of liquid waste disposal practices and environmental conservation activities. This is because of married households expect to have large family members; thus, they gave more time for their family patience than attending in liquid waste removal measures.

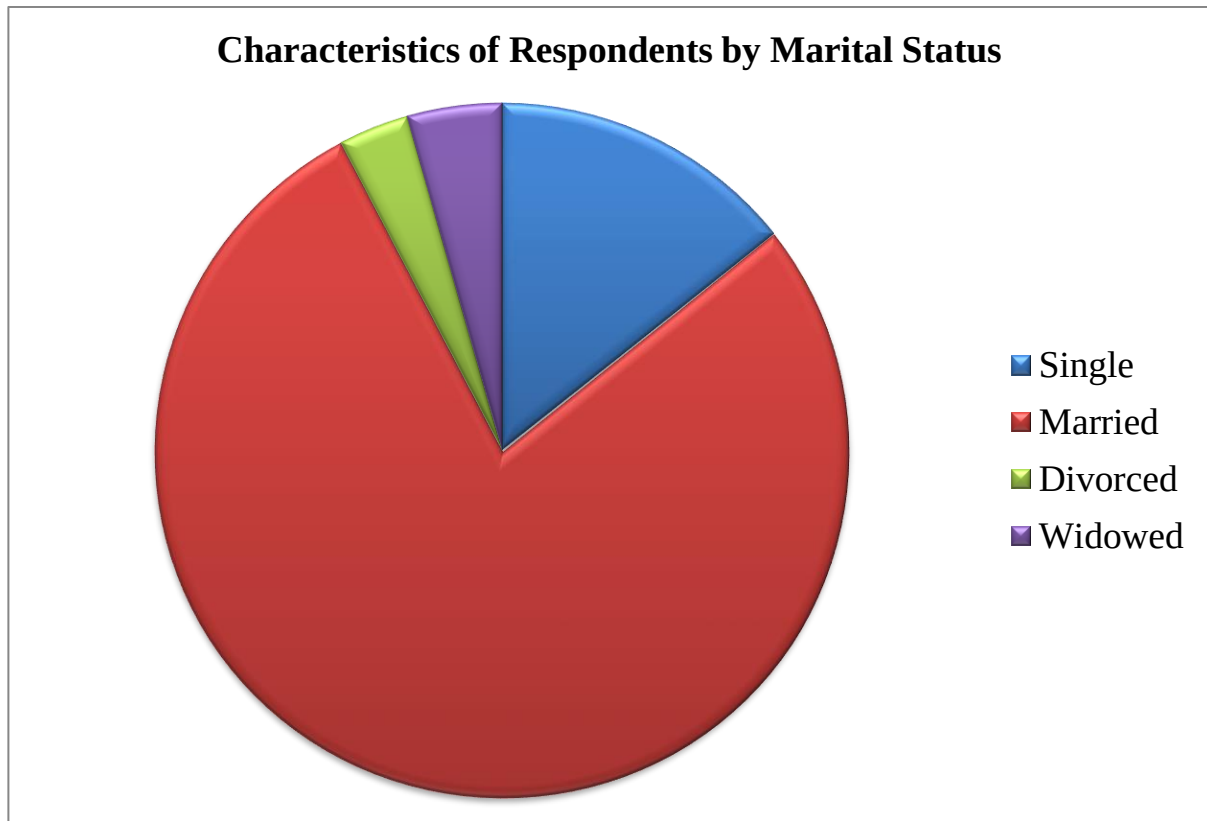


Figure 4.3: Marital Status of the Respondents

4.2.4 Educational Background of the Respondents

As shown in figure 4.4, of total respondents about, 66(12.1%) were unable to read and write or illiterate, 36(19.8%) of study participants were able to read and write, 35(19.2%) of respondents were attended in primary school (1-8), 26(25.8%) of households attended educations at secondary school, 17(9.3%) of respondents were qualified at certificate level, 8(8%) households had diploma holders and above education level. In general, the data showed that large proportion of respondents' educational status were illiterate and can write and read. Therefore, education is one the key factors and the most powerful tool to bring the desired socio-economic changes in a given society. Therefore, without education and relevant training the entire development of given community is unexpected or even without attending proper education

society could not understand liquid waste disposal practices in the study area. This means education affects the well-being of individuals or societies in general. Level of education is associated with the awareness of employees for improved hygiene practice.

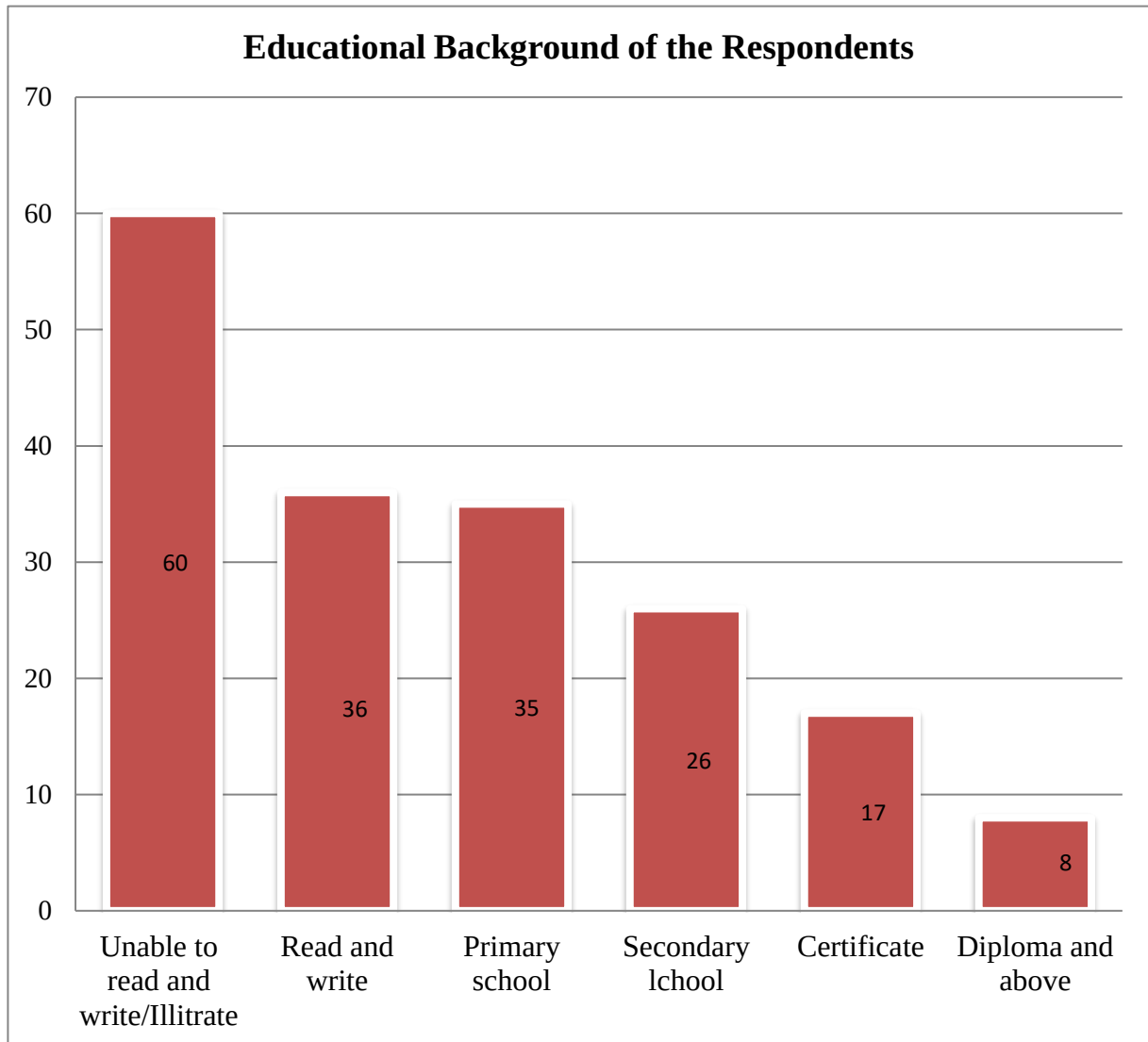


Figure 4.4: Educational Background of Respondents

4.2.5 Religion of the Respondents

As shown in figure 4.5, regarding religion of respondents, the majority 98(53.8%) of respondents were protestant faith followers, 20(11%) of respondents were embraced Ethiopian Orthodox Christianity followers, 58(31.7%) of them were Muslim and the remaining 6(3.3%) were others religion followers. This assertion is in tandem with Avvannavar and Mani (2008), they pointed out that Muslims constantly practice anal cleansing with water liquid disposal and

that this practice can be done in comfort in a confined place.

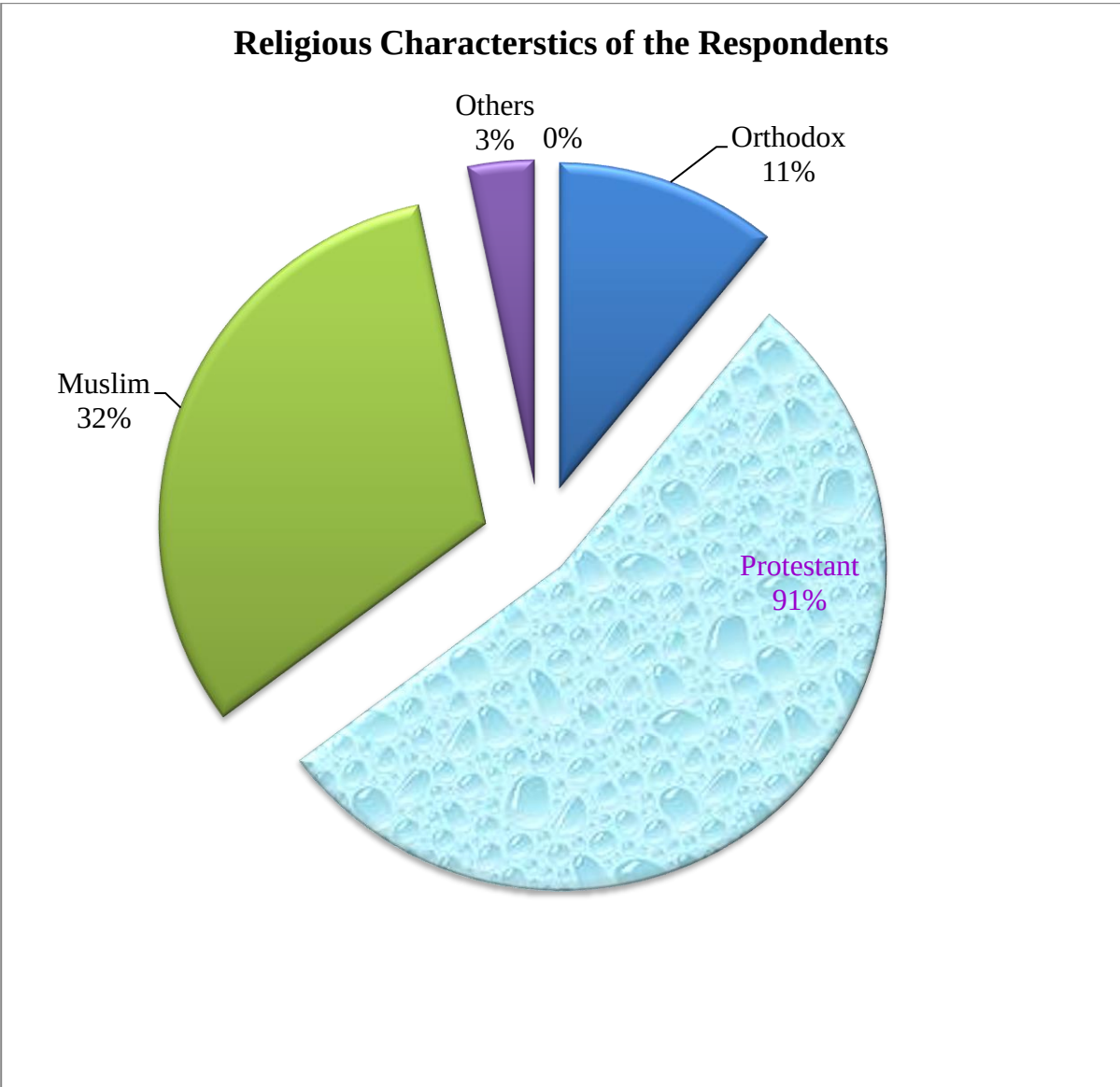


Figure 4.5: Religious Characteristics of the Respondents

4.2.6 Number of Family Size in the Household

As shown in figure 4.6, 48(26.4%) of households said that they live with family size between 1-3 individuals, 56(30.8%) of households reported that they live with family size between 4-6 and 78(42.9%) of households indicates that they live with family size above 7. This ensures that most of the households 104(57.1%) live with a family size below 7 and they have relatively small family size, even though the above indicated family size might have their own share on the consumption of family resources.

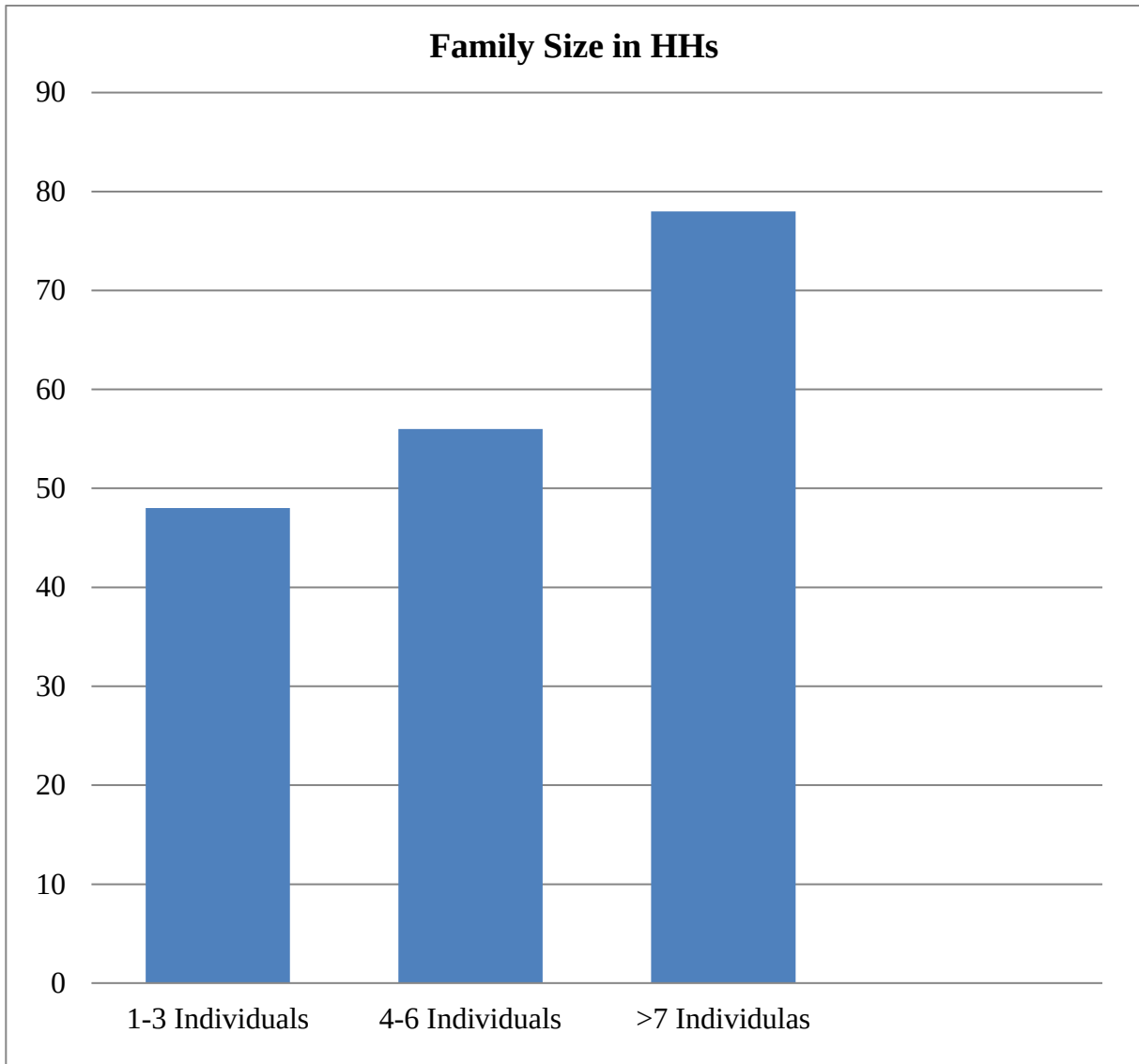


Figure 4.6: Family Size in the Household

4.2.7 Income Level of Study Participants

As it can be seen in Table 4.1, about 87(47.8%) of respondent's income level 4000 birr, 67(36.8%) of respondents showed that their income level was between 4001-6000 birr. Besides, 24(13.2%) of respondent's income level was between 6001-7000 birr. On the other hand, 4(2.2%) of respondents revealed that their income level 7001 and above. This implies that the majority of respondent's income levels performed low. This may be negatively affecting their saving habits in order to improve the access to building liquid waste disposal in the area. Similarly, Linda (2005), the income gained from different economic activities were used for households' consumption and family support rather than re-investing it to expand their business. They may

not also be able to invest in capital projects like modern farm technology and inputs as this normally attract huge financial obligation considering their low financial status.

Table 4.1: Income Level of the Respondents

S N	Income Per month in birr	No	%
1	4000	87	47.8
2	4001-6000	67	36.8
3	6001-7000	24	13.2
4	70001 and above	4	2.2
Total		182	100

Source: Field Survey, 2024

4.2.8 Job Description of Households in the Factory

Regarding respondent's job description of households as indicated in table 4.2 above about, 102(56%) of respondents were farming who depend only on agriculture activities, 60(33%) of study participants pointed out works as packaging food products, 7(3.8%) of respondents were safety and quality standards controls, 8(4.4%) of employees were operate machinery and 5(2.7%) of respondents were involved in monitor production lines. This implies, out of the five mentioned jobs description in the factory great majority of employees were involved in farming activities. The second main activity was safety and quality standards control and the third main job description were operating machinery.

Table 4.2: Job Description of Households in Factory

Job Description	Variables	No	%
	Farming only	102	56
	Packaging food products	60	3.3
	Safety and quality standards	7	3.8
	Operate machinery	8	4.4
	Monitor production lines	5	2.7
	Total	182	100

Source: Field Survey, 2024

4.2.9 Work Experience of Households in Factory

As it can be seen in Table 4.3, concerning work experiences of the study participants, 44(24.2%) of employees have the work of experience years ranging from 0-3 years, 69(37.9%) of study participants have experience range of 4-10 years, 37(20.3%) of respondents have 11-15 years' experience and the remaining 32(17.5%) of respondents were participated from 15 and above years in farm and Agro processing factory. This implies that the majority of respondents have less than 10 years' experience. This shows that experience of employees negatively influences

the effective participation of liquid waste disposal practices. According to Mutisya (2010) who noted that employees who have long experience in liquid waste disposal practices are more productive.

Table 4.3: Work Experience of the Respondents

SN	Work Experience	No	%
1	0-3 years	44	24.2
2	4-10 years	69	37.9
3	11-15years	37	20.3
4	>15 years	32	17.5
Total		182	100

Source: Field Survey, 2024

4.3 Analysis of the Findings of the Study

4.3.1 The major environmental and public health impacts associated with the liquid waste disposal practices

The following table describes about the major environmental and public health impacts associated with the liquid waste disposal practices. Thus, meanings of waste, significance of liquid waste disposal practice, frequency of factory dispose liquid waste, existence of temporary liquid waste storage and the types of liquid waste disposal materials were viewed in the following tables below.

As indicated for item 1 of Table 4.4 respondents were asked that whether do you know what waste mean or not, in this regard 179(98.3%) of households reported that they have known how about waste or yes while 3(1.7%) of them indicated that they don't know about the waste. Therefore, the above data indicated that majority 99% of households in the study know what does mean waste. On the other, respondents were requested that if yes for above question, answer for waste definition 101(55.5%) of households said that disposable materials produced by human or other, 72(39.5%) of respondents said that unwanted or unusable materials and the remaining 9(4.9%) of respondents indicated that waste is wanted or usable materials. It is possible to realize that waste means disposable materials produced by human or other and unwanted unusable materials those liquid disposal materials in the study area. Respondents were requested that what do you think of liquid waste? Do you think of liquid waste are, in this concern, 117(64.3%) of respondents requested that liquid waste is useless, 47(25.8%) of respondents said that useful and the reaming 18(9.9%) of employees said that liquid waste is somewhat useful.

In the same table respondents were asked that whether do you agree with the importance of liquid waste disposal or not, in this concern, 169(92.9%) of households reported that they agree about the importance of liquid waste disposal while 13(7.1%) of them indicated that they don't agree the importance of liquid waste disposal. Likewise, respondents were requesting how often factory dispose liquid waste, 9(4.9%) of households reported that every day, 8(4.4%) of respondents indicated that every third day, 52(28.6%) of respondents indicated that every five day and the remaining and majority 113(62.1%) of households showed that the factory dispose liquid waste once in a month in the study area.

As can be observed from Table 4.4, households asked for do factory have a temporary liquid waste storage or not, in this regard, 30(16.5%) of households reported that the factory have a temporary liquid waste storage while 152(83.5%) of them indicated that the factory have no a temporary liquid waste storage. On the other hand, respondents requested if your answer is for above question is "Yes" what materials do factory use to collect liquid waste, 6(20%) said factory uses storage tanks, 5(16.7%) of respondents said that factory have temporary drums and barrels, 12(40%) of respondents said that factory uses pipes and hoses for liquid waste storage, 4(13.3%) of respondents said that factory uses sumps and pits for liquid waste storage, liquid waste storage and the remaining 3(10%) of households pointed out that the factory uses filters and screens for storage liquid waste storage. It is possible to realize that the majority of respondents reported that the factory unable to use temporary liquid waste storage in the study area. However, among the materials of factory majority indicated that factory uses pipes and hoses and storage tanks to collect liquid waste in the area.

Key interview informants asserted that in a food processing factory, various types of liquid waste are generated, each with distinct characteristics and potential environmental implications. Primarily, organic effluents are produced, consisting of water infused with food remnants, oils, and fats from the processing of raw ingredients. Additionally, cleaning wastewater arises from the routine sanitation of equipment and surfaces, often containing a mixture of detergents, sanitizers, and other chemicals necessary for maintaining hygiene standards. Process water runoff is another significant contributor, as water utilized in cooking, boiling, or other preparation methods can carry organic materials and chemical residues. Moreover, packaging wastewater emerges from the washing and rinsing of packaging materials, potentially introducing additional contaminants. Then, beverage contribute to the liquid waste stream, as

accidental leaks during production can introduce sugars and acids, complicating waste treatment efforts. Collectively, these liquid waste types pose challenges for effective management and underscore the need for sustainable practices in the food processing industry.

Table 4.4: The knowledge related questions to households' liquid waste disposal practice

Items		Households (n = 182)	
		Frequency	%
Do you know what waste mean	Yes	179	98.3
	No	3	1.7
If yes for above question, answer for waste definition?	Disposable materials produced by human or other	101	55.5
	Unwanted/unusable materials	72	39.5
	Wanted/usable materials	9	4.9
What do you think of liquid waste? Do you think of liquid waste are	Useless	117	64.3
	Useful	47	25.8
	Somewhat useful	18	9.9
Do you agree with the importance of liquid waste disposal	Yes	169	92.9
	No	13	7.1
How often do Elfora Melge Farm and Agro Processing Factory dispose liquid waste?	Every Day	9	4.9
	Every third day	8	4.4
	Every five day	52	28.6
	Once in a month	113	62.1
Do factory have a temporary liquid waste storage?	Yes	30	16.5
	No	152	83.5
If your answer is for above question is "Yes" what materials do factory use to collect liquid waste?	Storage Tanks	6	20
	Drums and barrels	5	16.7
	Pipes and hoses	12	40
	Sumps and pits	4	13.3
	Filters and screens	3	10

Source: Field Survey, 2024

Regarding, availability of liquid waste disposing materials among households were requested that is liquid waste disposing container available in neighborhood, 47(25.8%) of households said yes in relation to the availability of liquid waste disposing container and while majority 135(74.2%) of households indicated that liquid waste disposing container not available in our neighborhood. Similarly, respondents were requested that do your temporary storage liquid waste in your house, in this regard, 27(14.8%) of households said yes and while 155(85.2%) of respondents reported that no. This means temporary storage liquid waste absence in respondents' house or neighborhood.

Similarly, respondents were asked that do you separate liquid wastes before dumping (see table 4.5), 24(13.2%) of households reported that yes and 158(86.8%) of them said that didn't

separate liquid wastes before dumping. Therefore, it is possible to realize that the majority (86.8%) of respondents didn't separate liquid wastes before dumping. In addition, employees asked for do you store liquid waste generated from your house until solid waste collectors come to your home, in this regard, 34(18.7%) of households reported that store liquid waste generated from house until solid waste collectors come to your home and 148(81.3%) of households said that don't store liquid waste generated from house until solid waste collectors come to home. Respondents were asked that do you dumping liquid waste in open spaces or not (see table 4.5), 54(29.7%) of households said that dumping liquid waste in open spaces and 128(70.3%) of households said that don't dumping liquid waste in open spaces. On the other hand, do you disposing liquid waste on road side or not, 138(75.8%) of households said that do you disposing liquid waste on road side and 44(24.2%) of households said that incapable to disposing liquid waste on road side.

On the other hand, table 4.5, households were asked that do your disposal liquid waste in the yard, in this concern, 126(69.2%) of respondents indicated disposal liquid waste in the yard and 56(30.8%) of them said that do not disposal liquid waste in the yard. Respondents were requested the do you segregate liquid waste at home, 23(12.6%) of employees reported that segregate liquid waste at home and 159(87.4%) of them indicated that they incompetent to segregate liquid waste at home. Similarly, 88(24.2%) of households said that the practice source reduction strategy and the remaining 104(57.1%) of respondents reported that do not practice source reduction strategy. Similarly, van Dijk et al. (2013), about 2.6 billion people have no access to improved sanitation. Due to this, different environmental media such as water and soil are being affected by contaminants (Pirastu et al., 2013). Even though the liquid waste handling facilities are increasing substantially in developed countries, the situation is different in developing countries (Manderso, 2018). In general, this statement suggests an investigation into the level of awareness and understanding that households have regarding their liquid waste disposal practices, which can be critical for assessing and improving waste management strategies in the community.

Table 4.5: Availability of liquid waste disposing materials among household's house

Items		Households (n = 182)	
		Frequency	%
Is liquid waste disposing container available in your neighborhood?	Yes	47	25.8
	No	135	74.2

Do your temporary storage liquid waste in your house?	Yes		27	14.8
	No		155	85.2
Do you separate liquid wastes before dumping	Yes		24	13.2
	No		158	86.8
Do you store liquid waste generated from your house	Yes		34	18.7
	No		148	81.3
Do you dump liquid waste in open spaces	Yes		54	29.7
	No		128	70.3
Do you dispose liquid waste on road side	Yes		138	75.8
	No		44	24.2
Do your disposal liquid waste in the yard	Yes		126	69.2
	No		56	30.8
Do you segregate liquid waste at your home	Yes		23	12.6
	No		159	87.4
Did you practice source reduction strategy	Yes		78	42.9
	No		104	57.1

Source: Field Survey, 2024

As it can be seen in table 4.6, concerning socio economic- related factors of liquid waste disposal practices, 66(36.3%) of respondents indicated distance of house from main roads is between 1.0-200m and 116(63.7%) of households reported that distance of house from main roads greater than 200meters. It is possible to realize that the majority of respondents conformed that distance of house from main roads more than 200m. Similarly, 20(11%) of respondents reported that their waste bin/container in neighborhood and while 162(89%) of households indicated that there are waste bin/container in neighborhood.

On the other hand, respondents were asked that are you willing to pay for the solid waste collector's service in order to improve liquid waste disposal practice, in this concern, 149(81.9%) of respondents indicated willing to pay for the solid waste collector's service in order to improve liquid waste disposal practice in kebele, 33(18.1%) of households reported that unable to willing to pay for the solid waste collector's service in order to improve liquid waste disposal practice. In most developing countries, lack of sanitation infrastructure has been the main reason for the poor liquid waste handling practice (Joshi and Amadi, 2013).

Table 4.6: Socio economic- related factors of liquid waste disposal practices

Items		Households (n= 182)	
		Frequency	%
Distance of house from main roads	10m-200m	66	36.3
	2. Greater than 200m	116	63.7
Are there waste bin/container in neighbor hood	Yes	20	11
	No	162	89

Are you willing to pay for the liquid waste collector's service in order to improve liquid waste disposal practice in your kebele	Yes	149	81.9
	No	33	18.1

Source: Field Survey, 2024

Focus group discussant pointed out that disposal of liquid waste has a major impact on local waterquality and ecosystem health, particularly through contamination and nutritional contamination. When untreated and untreated liquid waste is released into nearby waters, harmful substances such as heavy metals, pathogens and organic pollutants can enter the aquatic environment, putting the health of the organisms living in these ecosystems at risk. Increased nutrient levels, especially nitrogen and phosphorus, lead to eutrophication, causing a decrease in algae flower and oxygen levels, impairing lifespan in the water and disrupt food chains. Furthermore, changes in water temperature and chemical composition can affect both terrestrial and aquatic species, leading to reduced biological diversity and general ecosystem resilience. Ultimately, these effects can have a cascade effect on human health, local economy and the integrity of the natural environment, highlighting the need for improved waste management practices and guidelines to ensure ecosystem water quality and health.

Figure 4.7: Focus group discussion participants



Respondents were asked that do you know that there are rules and regulations of liquid wastes management in the study area, in this concern, 164(90%) of households conformed that they don't aware about rules and regulations of liquid wastes and the remaining 18(10%) of households said yes, we know that there are rules and regulations of liquid wastes. Similarly, respondents were requested that rules and regulations enforcement on liquid waste disposal,

40(22%) of households said that none at all, 122(67%) majority of them said that regulation is weak and the remaining 20(11%) of households reported that regulation is strong. Therefore, from the above data one can be inferred that the rules and regulations that prevent liquid waste disposal practices were weak and not strong. Question also requested that liquid waste disposal practices does access to door-to-door collection service or not, in this regard, 169(92.9%) of households said that there is no access to door-to-door collection service to reduce waste liquid disposal practices. Similarly, 13(7.1%) of them said that there is access to door-to-door collection service to reduce waste liquid disposal practices. Due to this, the planning and expansion of sanitary infrastructures in most African countries are very difficult (Loucks and van Beek, 2017). Many governments of African country do not give attention to wastewater collection and handling facilities because they are dealing with war, conflict and food security (Haddis et al., 2014). Moreover, the habit of open field disposal is another big problem in developing countries (Shrestha, 2018).

Table 4.7: Institutional- related factors of liquid waste disposal practices

Items		Households (n= 182)	
		Frequency	%
Do you know that there are rules and regulations of liquid wastes	Yes	18	10
	No	164	90
Rules and regulations enforcement on liquid waste disposal	None at all	40	22
	Regulation is weak	122	67
	Regulation is strong	20	11
Have you ever seen when violators of regulation in liquid waste disposal are penalized?	Yes	12	6.6
	No	170	93.4
Does access to door-to-door collection service?	Yes	13	7.1
	No	169	92.9

Source: Field Survey, 2024

4.3.2 Potential public health risks associated factor affecting liquid waste disposal practices

The following table presents about the potential public health risks associated factor affecting liquid waste disposal practices includes poor coordination, lack of rules and regulations, lack of initiative, dumping site problems and high resource consumption.

Table 4.8: The factor affecting liquid waste disposal practices

SN	Items	Households (N=182)							
			SDA	DA	N	A	SA	Mean	SD
1	Poor Coordination	N	4	27	35	76	40	4.15	.966

		%	2.2	14.9	19.2	42	22.1		
2	Financial shortage	N	10	22	25	55	70	4.12	1.34
		%	5.5	12.1	13.7	30.4	38.7		
3	Lack of rules and regulations	N	5	22	34	52	60	4.36	.858
		%	2.8	12.1	18.7	28.7	33.1		
4	Lack of initiative	N	15	17	20	39	90	4.60	1.44
		%	8.3	9.4	11.5	21.5	49.7		
5	Unreliable service	N	7	10	29	66	70	4.58	1.45
		%	3.9	5.5	15.9	36.5	38.7		
6	Dumping site problems	N	6	16	40	70	50	3.90	1.51
		%	3.3	8.8	22	38.7	27.6		
7	Lack of awareness	N	10	26	29	68	49	4.32	1.34
		%	5.5	14.4	15.9	37.6	27.1		
8	Lack of containers	N	4	20	34	64	60	4.47	1.39
		%	2.2	11.0	18.7	35.4	33.1		
9	High resource consumption	N	10	28	41	66	37	3.60	1.33
		%	5.5	15.5	22.5	36.5	20.4		
Aggregate mean								4.23	

Source: Field Survey (2024)

Key: SDA= Strongly Disagree (1.00-1.49) DA=Disagree (1.50-2.49) N= Neutral (2.50-3.49), A=Agree (3.50-4.49) and SA=Strongly Agree (4.50-5.00). M- is mean, SD- is standard deviation. Source according to Zaidaton and Bagheri (2009) the mean score below 2.49 was considered as disagree, the mean score from 2.50 up to 3.49 was considered as neutral and mean score above 3.50 was considers as agree as illustrated by comparison bases of mean of score of five-point Likert scale instrument.

As depicted in the above Table, Table 4.8, item 1, respondents were asked that whether potential public health risks associated factor affecting liquid waste disposal practices in relation to poor coordination, in this regard, 31(17.1%) of households disagreed that poor coordination while 116(64.1%) of households agreed that there is poor coordination. On the other hand, 35(19.2%) households revealed impartial about the poor coordination. In contrast to this, the mean score (M=4.15, SD=.966) reported that the poor coordination is the potential public health risks associated factor affecting liquid waste disposal practices.

Interview data show that the households getting unreliable service or inability to get the necessary service in liquid waste disposal practices from municipality or government officials has strong factor on community participation. Moreover, the poor performance of the municipalities in this respect is rooted in short supply of funds, inappropriate equipment, inefficient management and unskilled personnel. Other important managerial problems are those related to financial issues, because these determine reliability and sustainability of a

service for a major part, notable inadequate fee collection.

As it can be seen in Table 4.8, item 2, concerning the financial shortage, 32(17.6%) of households are disagreed in relation to financial shortage and 125(69.1%) of respondent showed that there is financial shortage to decrease public health risks associated factor affecting liquid waste disposal practices. In contrast to this, 25(13.7%) of households said that the financial shortage at moderate level. Similarly, the mean score ($M=4.12$, $SD=1.34$) showed that financial shortage was one of the potential public health risks associated factor affecting liquid waste disposal practices.

According to the interviewees, factory liquid waste disposal practice is given low priority and very limited funds are allocated to the factory and lack of financial management and planning, particularly when this limited resources available for the factory are completed quickly and causes liquid waste disposal services to halt for some periods, will result in losing trust of service users. Therefore, financial constraint is one of the factors affecting effective liquid waste disposal.

Table 4.8, item 3, respondents were asked that the whether the lack of rules and regulations are potential public health risks associated factor affecting liquid waste disposal practices or not, 27(14.9%) of households showed that there is rules and regulations while 112(61.8%) of study respondents indicated that lack of rules and regulations. On the other hand, 34(18.7%) of study participants revealed that there is reasonable rules and regulations in the study area. In contrast to this, the mean score ($M=4.36$, $SD=.858$) reported that lack of rules and regulations are potential public health risks associated factor affecting liquid waste disposal practices.

The study has found that lack of adequate legislation makes it difficult to assign clear mandates to different sectors connected with waste management services. The rules and regulations and their implementation program at Bussa Kebele were weak. On the other hand, there was no enough effort made to create awareness about liquid waste disposal practices in the community including the rules and regulations and associated penalties in a regular basis. Factor like lack of rules and regulation, the least of all effect, lack of incentive and financial shortage influential factors.

According to Table 4.8, item 4, asked for lack of initiative is the public health risks associated factor affecting liquid waste disposal practices or not. In this regard, 32(17.7%) of respondents

showed that lack of initiative doesn't affecting liquid waste disposal practices. while 129(61.2%) of respondent showed that lack of initiative affecting liquid waste disposal practices. In contrast to this, 20(11.5%) of respondents said that lack of initiative moderately affecting liquid waste disposal practices. Similarly, the mean score ($M=4.60$, $SD=1.44$) showed that lack of initiative affecting liquid waste disposal practices.

As shown in the above Table, item 5, respondents were asked that unreliable service, 17(9.4%) of households reported that there is reliable service while 136(75.2%) of study respondents agreed that in relation to unreliable service. On the other hand, 29(15.9%) of study participants conformed that reasonable reliable service. In contrast to this, the mean score ($M=4.58$, $SD=1.45$) reported that the unreliable service is one of the factors affecting liquid waste disposal practices.

As indicated in Table 4.8, item 6, asked for whether dumping site problems or not, 22(12.1%) of households disagreed in relation dumping site problems while 120(66.3%) of respondent showed that dumping site problems is the potential public health risks associated factor affecting liquid waste disposal practices. In contrast to this, 40(22%) of respondents indicated that there are moderate dumping site problems. Likewise, the mean score ($M=3.90$, $SD=1.51$) showed that dumping site problems are potential public health risks associated factor affecting liquid waste disposal practices.

Table 4.8, item 7, respondents were asked that whether there is lack of awareness or not, in this concern, 36(19.9%) of households reported that there is awareness while 117(64.7%) of households showed that lack of awareness. On the other hand, 29(15.9%) of study participants revealed that there was moderate awareness of households in relation to potential public health risks associated liquid waste disposal practices. In contrast to this, the mean score ($M=4.32$, $SD=1.34$) reported that households lack of awareness about potential public health risks associated factor affecting liquid waste disposal practices.

Public awareness and attitudes toward waste can affect the factory liquid waste management system. All steps in factory liquid waste management starting from household waste storage, to waste segregation, recycling, collection frequency, willingness to pay for waste management services, and disposal facilities depend on public awareness and participation. Thus, lack of public awareness and training about the importance of proper liquid waste management for

health and well-being of people, severely restricts use of community-based approaches and also crucial factor for failure for liquid waste disposal practices in the kebele/town as it is the case in most parts of the towns in the region. Most proportions of the respondents agreed that lack of awareness has effect on good liquid waste disposal practices.

As it can be seen in Table 4.8, item 8, in relation to infrastructure factor lack of containers, 24(12.2%) of households disagreed about lack of containers while 124(68.5%) of respondent agreed that in relation lack of containers. In contrast to this, 34(18.7%) of study participants said that lack of containers moderately affecting liquid waste disposal practices. Similarly, the mean score ($M=4.47$, $SD=1.39$) showed that liquid waste disposal practices affecting public health risks.

Table 4.8, item 9, asked for liquid waste disposal whether high resource consumption, or not, regarding to this issue, 38(21%) of households showed that don't high resource consumption while 103(56.9%) of study respondents indicated that high resource consumption. On the other hand, 41(22.5%) of study participants revealed that liquid waste disposal practices moderate resource consumption. In contrast to this, the mean score ($M=3.60$, $SD=1.13$) reported that liquid waste disposal practices high resource consumption. Almost all of the sewerage systems and wastewater treatment plants in Ethiopia are poorly managed (Haddis et al., 2014). The coverage of sanitation facilities in the country is very low (Admassu et al., 2004). About half of the households in Ethiopia openly discharge grey water into public properties such as drainage lines, streets, and nearby open spaces, and only 4.5 percent of Ethiopians have access to flush and pit latrines (Manderso, 2018).

4.3.3 Analysis of Variables Information

4.3.3.1 Community Awareness about Liquid waste Disposal

This part of the study investigates data about community awareness includes importance of liquid waste disposal practices, roles of community on liquid waste disposal practices and policies and guidelines of liquid waste disposal practices were presented in table 4.9 below.

Table 4.9: The community awareness about liquid waste disposal

SN	Items	Households (N=182)							
			SDA	DA	N	A	SA	Mean	SD
1	Community has active awareness of liquid waste disposal practices	N	10	12	16	48	96	3.74	1.20
		%	5.5	6.6	8.8	25.5	53		

2	Importance of liquid waste disposal practices	N	10	11	45	50	66	3.91	1.10
		%	5.5	6.1	24.7	27.6	36.5		
3	Importance and benefits of liquid waste disposal practices to environment	N	10	12	38	61	60	4.16	.888
		%	5.5	6.6	20.9	33.7	33.1		
4	Roles of community on liquid waste disposal practices	N	10	15	41	47	69	4.03	1.02
		%	5.5	8.3	22.5	26	38.1		
5	Policies and guidelines of liquid waste disposal practices	N	12	20	49	71	30	3.81	1.13
		%	6.6	11	26.9	39.2	16.6		
Aggregate mean								3.93	

Source: Field Survey (2025)

As it can be seen in Table 4.9, item 1, asked for community have active awareness of liquid waste disposal practices in the study area, 22(12.1%) of households disagreed about community have active awareness of liquid waste disposal practices while 144(78.5%) of respondent agreed that community have active awareness of liquid waste disposal practices. In contrast to this, 16(8.8%) of study participants reported that community have reasonable awareness of liquid waste disposal practices. Similarly, the mean score ($M=3.74$, $SD=1.20$) showed that the community have no active awareness of liquid waste disposal practices.

As indicated in Table 4.9, item 2, respondents were asked that whether importance of liquid waste disposal practices or not, 21(11.6%) of customers disagreed the importance of liquid waste disposal practices while 116(64.1%) of respondent agreed that importance of liquid waste disposal practices. In contrast to this, 45(24.7%) of respondents indicated that importance of liquid waste disposal practices is moderately. Similarly, the mean score ($M=3.91$, $SD=1.10$) showed that it is importance of liquid waste disposal practices effective implemented.

Table 4.9, item 3, respondents were asked that the whether the importance and benefits of liquid waste disposal practices to environment, 22(12.1%) of households showed that don't importance and benefits of liquid waste disposal practices to environment while 121(66.8%) of study respondents indicated that importance and benefits of liquid waste disposal practices to environment. On the other hand, 38(20.9%) of study participants revealed that reasonable importance and benefits of liquid waste disposal practices to environment. In contrast to this, the mean score ($M=4.16$, $SD=.888$) reported that importance and benefits of liquid waste

disposal practices to environment. In general, the data showed that the importance and benefits of liquid waste disposal practices to environment in the study area.

According to Table 4.9, item 4 asked there are roles of community on liquid waste disposal practices or not. In this regard, 25(13.8%) of respondents showed that there are no roles of community on liquid waste disposal practices while 116(64.1%) of respondent showed that there are roles of community on liquid waste disposal practices. In contrast to this, 41(22.5%) of respondents said that there are moderate roles of community on liquid waste disposal practices. Similarly, the mean score ($M=4.03$, $SD=1.02$) showed that the there are roles of community on liquid waste disposal practices.

As it can be seen in Table 4.9, item 5, asked for the policies and guidelines of liquid waste disposal practices or not, 32(17.6%) of households disagreed about the policies and guidelines of liquid waste disposal practices while 101(55.8%) of respondent agreed that the policies and guidelines of liquid waste disposal practices. In contrast to this, 48(25.5%) of households said that the policies and guidelines of liquid waste disposal practices at neutral level. Similarly, the mean score ($M=3.81$, $SD=1.13$) showed that the policies and guidelines of liquid waste disposal practices in the study area.

4.3.3.2 Surrounding Environmental Impact

This part of the analysis describes about surrounding environmental impact includes get involved in trying to solve environmental problems; the environment can recover on it's from problems caused by humans and to reduce the effects of climate change. These are presented in table 4.10 below:

Table 4.10: Surrounding environmental impact

SN	Items	Households (N=182)							
			SDA	DA	N	A	SA	Mean	SD
1	Do you get involved in trying to solve environmental problems	N	9	29	41	43	60	3.71	1.03
		%	5	16	22.5	23.8	33.1		
2	How well do you think the environment can recover on it's from problems caused by humans?	N	10	26	55	39	52	3.80	.795
		%	5.5	14.4	30.2	21.5	28.7		
3	The way of liquid waste reduces the damage you cause to the environment	N	10	29	28	51	64	4.15	.838
		%	5.5	16	15.4	28.2	35.4		
4	We can all do our bit to reduce the effects of climate change	N	10	26	29	44	73	3.98	.711
		%	5.5	14.4	15.9	24.4	40.4		

				4		3	3		
5	Nothing I do on a daily basis contributes to the problem of climate change	N	11	20	35	50	66	3.86	.857
		%	6.1	11	19.2	27.6	36.5		
Aggregate mean								3.90	

Source: Field Survey (2025)

Table 4.10, item 1, respondents were asked that do you get involved in trying to solve environmental problems or not, regarding to this issue, 38(21%) of households showed that incompetent get involved in trying to solve environmental problems while 103(56.9%) of households showed that get involved in trying to solve environmental problems. On the other hand, 41(22.5%) of study participants revealed that get involved in trying to solve environmental problems at neutral level. It is possible to realize that, the mean score ($M=3.60$, $SD=1.13$) respondents get involved in trying to solve environmental problems were surrounding environmental impact of affecting liquid waste disposal practices.

Table 4.10, item 2, respondents were asked that how well do you think the environment can recover on it's from problems caused by humans while 91(50.2%) of households indicated the environment cannot recover on it's from problems caused by humans. In contrast to this, 55(30.2%) of study participants said that the environment can moderately recover on it's from problems caused by humans. Similarly, the mean score ($M=3.80$, $SD=.795$) showed that the environment can recover on it's from problems caused by humans. It is possible to realize that the environment can recover on it's from problems caused by humans.

Table 4.10, item 3, asked for whether the way of liquid waste reduce the damage you cause to the environment, 39(21.5%) of households showed that the way of liquid waste not reduce the damage you cause to the environment while 115(63.6%) of study respondents indicated the way of liquid waste reduce the damage you cause to the environment. On the other hand, 28(15.4%) of households revealed that the way of liquid waste reasonable reduce the damage you cause to the environment. In contrast to this, the mean score ($M=4.15$, $SD=.838$) reported that the way of liquid waste reduces the damage cause to the environment.

Table 4.10, item 4, respondents were asked that liquid waste disposal practice whether to reduce the effects of climate change or not, 36(19.9%) of households showed that liquid waste disposal practices don't reduce the effects of climate change while 117(64.6%) of study respondents indicated that liquid waste disposal practice reduce the effects of climate change. On the other

hand, 29(15.9%) of study participants revealed that liquid waste disposal to reduce the effects of climate change at neutral level. In contrast to this, the mean score ($M=3.98$, $SD=.711$) reported that liquid waste disposal practice to reduce the effects of climate change in the study area.

As it can be seen in Table 4.10, item 5, asked for daily basis contributes to the problem of climate change or not, 31(17.1%) of household's daily basis contributes to the problem of climate change while 116(64.1%) of respondent agreed that daily basis contributes to the problem of climate change. In contrast to this, 35(19.2%) of households said that daily basis contributes to the problem of climate change. Similarly, the mean score ($M=3.86$, $SD=.857$) showed that the daily basis contributes to the problem of climate change.

4.3.3.3 Disposal management practices in the factory

This part of the study examines data about the management practices in the factory such as proper segregation, recycling, transporting and disposing was responded by the respondents of the study as can be viewed from the following table below.

Table 4.11: Disposal management practices in the factory

S N	Items	Households (N=182)							
			SDA	DA	N	A	SA	Mea n	SD
1	Proper segregation	N	10	11	21	61	78	4.02	1.16
		%	5.5	6.1	11.6	33.7	43.1		
2	Proper recycling	N	27	9	17	74	54	3.63	1.38
		%	14.9	4.9	9.4	40.8	29.8		
3	Proper transporting	N	11	8	49	75	38	3.65	1.07
		%	6.1	4.4	27.1	41.4	21		
4	Proper disposing	N	12	7	9	102	51	3.95	1.06
		%	6.6	3.9	4.9	56.4	28.2		
Aggregate mean							3.82		

Source: Field Survey (2024)

As it can be seen in Table 4.11, regarding the proper segregation 76.8% with mean score 4.02, proper recycling 70.6% with its mean score 3.63, proper transporting 62.4% with its mean score 3.65 and proper disposing 84.6% with mean score 3.95 were identified that liquid waste disposal practices in the factory in the study area.

4.3.3.4 Cost for liquid waste

This part of the study examines data about the disposal practices in the factory such as proper segregation, recycling, transporting and disposing was responded by the respondents of the

study as can be viewed from the following table below.

Table 4.12: Cost for liquid waste

S N	Items	Households (N=182)							
			SD A	DA	N	A	SA	Me an	SD
1	Should the factor provide more money to support liquid waste disposal practices	N	13	41	8	58	62	3.6 1	1.37
		%	7.2	22.7	4.4	32	34.3		
2	Do the factory pay container fees for municipal	N	13	25	7	71	66	3.8 3	1.28
		%	7.2	13.8	3.8	39.2	36.5		
3	You don't want to pay	N	12	20	36	71	43	3.6 0	1.18
		%	6.6	11	19.8	39.2	23.8		
4	Do the factory charge per month for waste collection	N	6	6	20	62	88	4.3 6	.771
		%	3.3	3.3	11	34.3	48.6		
Aggregate mean								3.85	

Source: Field Survey (2024)

As respondents were requested that the factor provide more money to support liquid waste disposal practices, 66.3% with mean score (3.61, SD=1.37), the factory pay container fees for municipal 75.7% with mean score (3.83, SD=1.28), interest to pay 63% with mean score (3.60, SD=1.18) and the factory charge per month for waste collection 82.9% with mean score (4.36, SD=.771) were cost for liquid waste disposal practices that affecting human health risks. The liquid waste that is generated from industries, institutions, and residents is not being handled properly. Moreover, the overflow of storm water into the streets especially during the rainy season poses additional sanitation problems (McFarland et al., 2019). Wastewater typically contains disease-causing agents, oxygen demanding waste, water-soluble inorganic chemicals, inorganic nutrients, organic chemicals, sediments, radioactive waste (Amin et al., 2014).

4.3.3.5 Distance of dump site

The following table presents about the distance of dump site such as burning of waste in open dumpsite could result air pollution, there are enough garbage receptacles in towns and garbage truck cause some leakage of trash in to the road.

Table 4.13: Distance of dump site

S N	Items	Households (N=182)						
			SDA	DA	N	A	SA	Mean
1	Uncontrolled burning of waste in open dumpsite could result air pollution	N	15	25	35	31	76	4.07
		%	8.3	13.8	19.2	17.1	50	
2	There are enough garbage receptacles in towns	N	19	25	23	45	70	2.54
		%	10.5	13.8	12.6	24.9	38.7	

3	Garbage truck cause some leakage of trash in to the road	N	13	23	34	52	60	3.61	1.41
		%	7.2	12.7	18.7	28.7	33.1		
4	Garbage truck led to noise pollution that cause annoyance	N	16	20	16	30	90	4.07	1.01
		%	8.8	11	8.8	16.6	49.7		
5	Concerned distance dumpsite has impact to health problem for collection	N	10	16	20	66	70	3.96	1.11
		%	5.5	8.8	11	36.5	38.7		
Aggregate mean								3.86	

Source: Field Survey (2025)

As indicated in Table 4.13, item 1, respondents were requested that uncontrolled burning of waste in open dumpsite could result air pollution or not, 40(22.1%) of households showed that controlled burning of waste in open dumpsite could result air pollution while 107(67.1%) of respondents reported that uncontrolled burning of waste in open dumpsite could result air pollution. On the other hand, 35(19.2%) of households indicated that reasonable controlled burning of waste in open dumpsite could result air pollution. The mean score ($M=4.07$, $SD=1.01$) reported that uncontrolled burning of waste in open dumpsite could result air pollution.

According to Table 4.13, item 2, asked for there are enough garbage receptacles in towns or not. In this regard, 44(24.3%) of respondents showed that there are no enough garbage receptacles in towns, while 115(63.6%) of respondent showed that there are enough garbage receptacles in towns. In contrast to this, 25(13.8%) of respondents said that the there are moderate garbage receptacles in towns. The mean score ($M=2.54$, $SD=1.06$) showed that the there are no enough garbage receptacles in towns.

As it can be seen in Table 4.13, item 3, asked for garbage truck cause some leakage of trash in to the road or not, 36(19.9%) of households reported that garbage truck don't cause leakage of trash in to the road while 112(61.8%) of respondent agreed that garbage truck cause some leakage of trash in to the road. In contrast to this, 34(18.7%) of households said that garbage truck at reasonable cause leakage of trash in to the road. Similarly, the mean score ($M=3.61$, $SD=1.41$) showed that garbage truck cause leakage of trash in to the road.

As it can see in Table 4.4, item 4, respondents were asked that garbage truck led to noise pollution that cause annoyance or not, in this regard 36(19.8%) of households reported garbage truck led to no noise pollution that cause annoyance while 120(66.3%) of households indicated garbage truck led to noise pollution that cause annoyance. On the other hand, 16(8.8%) of study

participants said that garbage truck led to noise moderate pollution that cause annoyance. Similarly, the mean score ($M=4.07$, $SD=1.01$) showed that the garbage truck led to noise pollution that cause annoyance.

As it can be seen in Table 4.13, item 5, asked for concerned distance dumpsite has impact to health problem for collection or not. In this regard, 26(14.3%) of respondents showed that concerned distance dumpsite has no impact to health problem for collection, while 136(75.2%) of respondent showed that concerned distance dumpsite has impact to health problem for collection. On the other hand, 20(11%) of respondents said that concerned distance moderately dumpsite has impact to health problem for collection. The mean score ($M=3.96$, $SD=1.11$) showed that concerned distance dumpsite has impact to health problem for collection. Key interview informant said that to prevent contamination of local water sources, several measures of food processing plants are typically implemented, highlighting a combination of regulatory compliance, technical solutions, and commitment in municipalities. First, there is a robust wastewater treatment system that eliminates harmful contaminants and minimizes nutrient loads to effectively cleanse liquid waste before discharge. These systems include processes such as biological treatment, chemical precipitation, and advanced filtration techniques to ensure that the released water meets strict environmental standards. Regular testing and monitoring will be carried out to assess the effectiveness of these treatment systems and to identify leaks or violations that may lead to contamination. Furthermore, fabrics often cannot determine buffer zones or contaminated areas and prevent them from being supplemented by burial response protocols to actively tackle accidental releases. Furthermore, collaboration with local governments and environmental organizations will contribute to promoting transparency and accountability in water resource management, ensuring that both regulation and community health are prioritized. These comprehensive measures are jointly contributing to protecting local water sources from pollution and protection of surrounding ecosystems.

4.3.3.6 The implementation of liquid waste disposal

The following table presents about the implementation of liquid waste disposal such as liquid waste disposal practices is available all working time, management has commitment to implement the liquid waste disposal practices and the training is held in the proper order and level of trainees understanding was responded by the respondents of the study as can be viewed from the following table below.

Table 4.14: The implementation of liquid waste disposal

S N	Items	Households (N=182)							
			SDA	DA	N	A	SA	Mean	SD
1	Liquid waste disposal practices is available all working time	N	11	20	31	60	60	4.10	.801
		%	6.1	11	17.0	33.1	33.1		
2	Management has commitment to implement the liquid waste disposal practices	N	16	29	29	68	40	3.77	1.30
		%	8.8	16	15.9	37.6	22.1		
3	The training is held in the proper order and level of trainees understanding	N	16	27	24	55	60	3.85	1.39
		%	8.8	15	13.2	30.4	33.1		
4	Employees have active participation of the implementation of the liquid waste disposal practices	N	19	28	41	28	66	3.82	1.16
		%	10.5	15.5	22.5	15.5	36.5		
5	Employees have commitment to accept implementation of liquid waste disposal practices	N	10	14	23	45	90	3.90	1.20
		%	5.5	7.7	12.6	24.9	49.7		
Aggregate mean								3.89	

As it can be seen in Table 4.14, item 1, asked for liquid waste disposal practices is available all working time or not, in this regard, 31(17.1%) of households said that liquid waste disposal practices is not available all working time while 120(66.2%) of respondent agreed that liquid waste disposal practices is available all working time. In contrast to this, 31(17%) of households said that liquid waste disposal practices is moderately available all working time. Similarly, the mean score ($M=4.10$, $SD=.801$) showed that the liquid waste disposal practices is available all working time.

As it can be seen in Table 4.14, item 2, in relation to management has commitment to implement the liquid waste disposal practices or not, 45(24.8%) of households reported that management has not commitment to implement the liquid waste disposal practices, while 108(69.7%) of respondent showed that management has commitment to implement the liquid waste disposal practices. On the other hand, 29(15.9%) of respondents said that management has reasonable commitment to implement the liquid waste disposal practices. The mean score ($M=3.77$, $SD=1.30$) showed that the management has commitment to implement the liquid waste disposal practices.

As it can see in Table 4.4, item 8, respondents were asked that the training is held in the proper order and level of trainees understanding or not, in this regard 43(23.8%) of households reported the training is unable to held in the proper order and level of trainees understanding while

115(63.4%) of households indicated the training is held in the proper order and level of trainees understanding. On the other hand, 24(13.2%) of households said that the training is moderately held in the proper order and level of trainees understanding. Similarly, the mean score ($M=3.85$, $SD=1.39$) showed that the training is reasonable held in the proper order and level of trainees understanding.

As it can be seen in Table 4.14, item 4, asked for employees have active participation of the implementation of the liquid waste disposal practices or not. In this regard, 47(26%) of respondents showed that employees have not active participation of the implementation of the liquid waste disposal practices, while 94(52%) of respondent showed that employees have active participation of the implementation of the liquid waste disposal practices. On the other hand, 41(22.5%) of respondents said that employees have medium participation of the implementation of the liquid waste disposal practices. The mean score ($M=3.82$, $SD=1.16$) showed that employees have an active participation of the implementation of the liquid waste disposal practices.

As it can see in Table 4.14, item 5, respondents were asked that employees have commitment to accept implementation of liquid waste disposal practices or not, in this regard 24(13.2%) of households reported employees have no commitment to accept implementation of liquid waste disposal practices while 135(74.6%) of households indicated employees have commitment to accept implementation of liquid waste disposal practices. On the other hand, 23(12.6%) of households said that employees have medium commitment to accept implementation of liquid waste disposal practices. Similarly, the mean score ($M=3.90$, $SD=1.20$) showed that employees have commitment to accept implementation of liquid waste disposal practices. Focus group discussion asserted that several important recommendations

need to be implemented to improve the disposal of liquid waste in food processing plants and to protect both the environment and public health. First, factory should invest in state-of-the-art processing technology that effectively removes harmful contamination from liquid waste before it is released to ensure compliance with environmental regulations. The inclusion of the system in a closed circuit allows for setup by recycling and reuse of water, significantly reducing the amount of waste generated. Additionally, employees should be trained in best practices in waste management and promote a culture of sustainability and responsibility in relation to waste disposal. Regular monitoring of water quality in nearby ecosystems is important to id

entify unwanted impacts at the early stages and to take corrective actions. Including communities through transparency and education initiatives also encourages trust and cooperation in addressing pollution concerns. By taking over these measures, factories can minimize their ecological footprint while simultaneously protecting public health and local water resources.

Figure 4.8: Focus group discussion



4.4 Results of experimental Analysis

Table 4.15: Physicochemical characteristics of waste water close to factory

Wendo /Elfora Waste water							
<u>Physicochemical Analysis Result Report</u>							
Date of sampling	5/10/2016 E.C			Village	Wendo /Elfora		
Date of testing	5-10/10/2016 E.C			Source	Waste water		
Nature of sample	Treated			GPS	Northing		
					Easting		
					Altitude		
No	Parameters	Winter	Summer	Winter	Summer	Winter	Summer
1	TDS	1.78	10.91	16.44	13.47	2.06	9.72
2	BOD	30.00	34.50	16.95	21.97	46.08	49.04
3	COD	71.28	60.0	1.75	37.50	42.09	64.70
4	Hardness	0.0	4.50	-4.74	0.0	-5.42	33.19
5	Total alkalinity	4.51	-21.05	30.73	29.59	-8.66	-19.89

6	Ammonia	32.77	58.32	98.73	82.97	5.80	44.77
7	Nitrate	23.80	40.0	-372.4 1	-50	30.62	7.97
8	Chloride	14.04	10.69	-42.16	-65.21	-48.63	5.18
9	Phosphate	63.26	56.86	-36.51	43.22	-8.23	25.99
10	Sulphate	-22.44	63.29	-12.50	-74.86	-25.88	67.67

As shown in Table 15, the TDS, BOD, COD of all sampling points are above the acceptable limit and the COD level in all sampling points is lower than the minimum amount of chloride, phosphate and sulphate that should be present in the drinking water. Compared to sampling point, which represents the sampling point as the water enters into the kebele, the TDS, BOD, and COD load of the water increased in sampling points. This indicates that even though the characteristics of the water at sampling point is above the standard, the poor liquid waste handling practice of the Bussa kebele is affecting the water even more by increasing the pollutant load. Compared to sampling point TDS, BOD5, and COD of the drinking water are increased.

The presence of high TDS, BOD, and COD indicates that the drinking water is contaminated by the high amount of organic and inorganic matter in the river (Anawar and Chowdhury, 2020). This might have resulted from the effluent from small and large-scale factory and toilets. The effluents from garages might also be responsible for the presence of a high amount of organic matter in the drinking and river. The high amount of BOD and COD are also responsible for the reduction of BOD in the water (Bhateria and Jain, 2016). Since neighboring is contamination by water and food borne diseases. Therefore, to increase the quality of the biggest streams in the town should be kept protected from any kind of pollution. In general, during sampling researcher looks the extent of contamination of river or stream water by factory during summary and winter checking industrial discharge, temperature effects, water flow, biological impact and regulatory compliance. Environmental cleanliness and maintaining personal hygiene are therefore necessary to reduce food borne diseases. Food borne diseases include food borne in toxication's and food borne infections consumed by human beings, commonly referred to as food poisoning.

Uses of chemicals to ripen fruits/ antibiotic and hormone injections for better yield are in turn consumed and enter into our food cycle. Therefore, it can be inferred that contamination of river water by factories varies significantly between summer and winter due to several factors. During summer higher temperatures can lead to increased rates of evaporation and chemical reactions, potentially intensifying the toxicity of pollutants. Conversely, winter may cause lower temperatures, leading to reduced biological activity and slower degradation of contaminants. Additionally, seasonal changes in water flow and rainfall can either dilute pollutants or concentrate them, affecting the overall water quality. Factories may also discharge different types of waste depending on their production cycles, further contributing to fluctuations in contamination levels. Effective monitoring and regulatory compliance are crucial in addressing these seasonal disparities in river water contamination.

Figure 4.9: Taking of the water sample



Figure 4.10: The sample water poured in to the vessel



Figure 4.11: Entering the water sample testing laboratory



Figure 4.12: The water sample testing in laboratory



This sample test shows that the impact of liquid waste on local water bodies, specifically in the context of the Wondo Genet Melgue food processing factory, should outline the importance of water quality and the potential consequences of industrial waste. It may cover aspects such as the types of liquid waste generated by food processing, the specific parameters that can be measured (like pH, chemical oxygen demand, and heavy metals), and the significance of these measurements in assessing human and environmental health. The figure might also highlight the role of local water bodies in supporting biodiversity and community livelihoods, and set the stage for discussing the findings of the study and their implications for environmental policy and management. According to Parween and Ramanathan (2019), wastewater management is a systematic administration activity that provides proper collection, handling, treatment, and disposal of wastewater in an environmentally friendly way.

5. CONCLUSIONS AND RECOMMENDATIONS

In this chapter the conclusions and recommendations are discussed. For clarity purpose, the conclusions are based on the research objectives of the study. The main objective of this study was assessment of environmental and public health impacts associated with the liquid waste disposal practices from the Elfora Melge Farm and Agro Processing Factory in Wondo Bussa kebele, Oromia Region. To achieve the purpose of the study, attempt was made to get pertinent answers for the following research questions:

1. What are the major environmental and public health impacts associated with the liquid waste disposal Practices in case of Wondo Genet Melgue Food Processing Factory?
2. What is the impact of liquid waste on local water bodies by measuring parameters in a case of Wondo Genet Melgue food processing factory?
3. What are the potential public health risks associated with the discharged liquid waste from the Wondo Genet Melge food processing factory?

To search for answers for these questions, a descriptive and explanatory research design was employed. The data collected through questionnaires from closed ended questions was analysed and interpreted using appropriate statically tools such as frequency, percentage, mean and standard deviation and inferential statistics like binary logistic regression summary of major findings, conclusions, and implications of the study are presented in this chapter. On the basis of the analysis and interpretation of the data gathered through all the instruments, the following major conclusions and recommendations were drawn.

5.1 Conclusions

The main purpose of this study was to assessment of environmental and public health impacts associated with the liquid waste disposal practices from the Elfora Melge farm and Agro processing factory in Wondo Bussa kebele. Based on the findings the following conclusions are worth drawn.

- ❖ The data collected on the characteristics of the respondents were involved from different age groups and the great majority 82% of them was within adult aged group.
- ❖ Study showed that majority of households were married, from this fact, one can realized that most of married couple were more vulnerable than single or unmarried in terms of liquid

waste disposal practices and associated human health risk factors. This indicates that the majority of employees were protestant faith followers in the study area.

- ❖ Finding showed that the educational status, type of house ownership, and knowledge level were statistically significant associated factors with household liquid waste disposal practices. In general, it would be useful if the concerned bodies worked towards improving liquid waste disposal practices. More so, future research that spans multiple disciplines and involves multiple institutions is required.
- ❖ Finding of the showed that industrial skill problem like modern liquid waste management vehicle and equipment with accessible spare parts, professional qualification of personnel, lack of infrastructures like accessible of drainage systems and inland water ways were challenges in addressing effective liquid waste management in the Bussa Kebele.
- ❖ Result showed that social influences such as town/kebele public awareness on liquid waste management, the lack of adequate salary and benefits and low level of beneficiary's attitude for liquid waste workers were examined as affecting factor of effective liquid waste management. Also, institutional factors like an improper institutional setup, lack of integrated liquid waste disposal, and lack of involvement by many institutions in liquid waste disposal practices, insufficient and consistent waste disposal contract period with the municipality, and no integrated liquid waste disposal practices.
- ❖ Results indicates that the major problems aggravating household level liquid waste disposal in the town which includes: lack of institutional coordination, insufficient and unskilled man power, very low financial capacity, weak enforcement of rules and regulations, socio-cultural factors and lack of awareness among the community.
- ❖ Study revealed that majority of the household members around the Elfora Melge Farm and Agro processing factory use water for drinking from the main canal without treatment, and sometimes they withdraw surplus irrigation water directly
- ❖ The study showed that there is no waste separation activity around households and factory. This indicates that in addition to no reuse and recycling, different types of wastes storage and disposal at the same place without necessary precaution measure taken exacerbates the degradation, pollution and health problem on the environment and human beings through intake mechanism (as food, air, etc.).

- ❖ In the study area solid waste disposal in general and waste handling in particular is very poor, there is a problem of liquid waste segregation, collection, reuse, recycling, composting and disposal. Majority of respondents who live along the borders of rivers dispose their liquid wastes inside drainage channel and some others on the street and other vacant places.

5.2 Recommendations

Based on the findings of this study, the following recommendations were proposed

- ❖ Assess and address the gaps to manage liquid waste effectively. Improving coordination and collaboration among the various agencies and stakeholders involved in liquid waste management.
- ❖ Ensuring the construction and maintenance of liquid waste management infrastructure, such as septic tanks, sewage treatment plants, and drainage systems, meet the required standards.
- ❖ Establishing a comprehensive monitoring program to periodically assess the environmental and health impacts of liquid waste disposal. This should include measuring water quality parameters in local water bodies and monitoring of potential contaminants that could pose a public health risk.
- ❖ Handling liquid wastes appropriately is a key factor in improving the quality of life in study area. Therefore, it is suggested that researches need to be conducted on liquid, as well as solid waste handling practice of different towns of the region, to investigate the status of sanitation services and practices for improvement.
- ❖ Health care providers should closely observe children presenting with diarrhea and link their families with community health workers for monitoring and support at home to address sanitation and prevent recurrent episodes. The results show that the children in the case group were significantly affected by recurrent diarrhea compared to those in the control group.
- ❖ Identify and secure sustainable financing sources for the development and maintenance of liquid waste management infrastructure and services.
- ❖ Implementing technology for the treatment of advanced liquid waste and sustainable waste treatment practices in Elfora Melge farm and Agro processing factory. This includes introducing practices such as recycling and reuse of water, installing treatment systems, and using environmentally friendly disposal methods to minimize environmental impacts.

- ❖ Improving the quality of water through water testing and monitoring of public water sources and household water to ensure the water is fit for human consumption. The community advisable to get enough knowledge and education about sanitation, hygiene and the risk posed by liquid waste on the human health, especially cleaning areas with effectively in order to reduce contamination.
- ❖ Using community program for potential risks associated with liquid waste disposal. Provision of education on public health impacts and promoting community participation in monitoring efforts can encourage collaborative approaches to address issues related to liquid waste and impacts on local water.
- ❖ The town government and private firms better to ensure better liquid waste disposal practices through liquid waste reduction, reuse, and recycling of compost waste. The government should support business communities through pilot projects, funding training, and technical assistance information exchange follow up support and monitoring.

References

- Admassu, M., Wubshet, M. and Tilaye, T. (2004). Sanitary survey in Gondar town. *Ethiopian Journal of Health Development*, 17(3), 215-219.
- Amin, M. T., Alazba, A. A. and Manzoor, U. (2014). A review of removal of pollutants from water/wastewater using different types of nanomaterials. *Advances in Materials Science and Engineering*, 2014, Article ID 825910.
- Appannagari, R., (2017). Environmental Pollution Causes and Consequences: A Study. North Asian International Research Journal of Social Science & Humanities, Vol. 3(Issue-8).
- Asadul, H. (2018). Effects of Industrial Operations on Socio-Environmental and Public Health Degradation: Evidence from a Least Developing Country (LDC) October Sustainability. Issue DOI:10.3390/su10113948., p. 10(11):3948.
- Chukwu, O., 2008. Performance Evaluation of Locally Manufactured Rice Threshers in Niger State. *J. Eng. Appl. Sci.* 3(6), pp. 602-606.
- Colombani, N. (2018). Assessment of the anthropogenic fluoride export in Addis Ababa urban environment (Ethiopia). *Journal of Geochemical Exploration*. <https://doi.org/10.1016/j.gexplo.2018.04.008>, pp. 190, 390–399.
- Dadi D, (2017). Environmental and health impacts of effluents from textile industries in Ethiopia. the case of Gelan and Dukem, Oromia Regional State.
- Deeba. P., (2015). Environmental Laws and Management in India. Thomson Reuters, Legal. Khati M.
- ENVIRONMENTAL. Comenius University in Bratislava, Volume Epidemiology for Study of Public Health Vol.1. Epidemiology for Study of Public Health Vol.2., p. 253.
- Environmental Health Impact Assessment (EHIA) Process Environmental Health Impact Assessment (EHIA) Process International Conference on Environmental Health & Safety, www.conferenceseries.com/jape,
- Ethiop J Health Dev, pp. 30: 4249. Park, K., 2015. Park's Textbook of Preventive and Social Medicine. 23rd edition, Jhalpur: Bhanot Publishers.
- Fahir, M., (2012). Liquid Waste Management. the case of Bahir Dar, Ethiopia, pp. 26: 49-53.
- Fayiga, I., (2018). Metal Concentrations of some vegetables irrigated with industrial liquid waste at Kaki, Ethiopia. *SINET: Ethiopia Sci J*, pp. 21: 133-44.
- Grover, A. & S. R., (2020). Urban Health and Wellbeing: Indian Case Studies. Singapore: Springer.

- nger NatureGurumurthy, I. V., 2016.
- Haddis, A., De Geyter, A., Smets, I. and Van Der Bruggen, B. (2014). Wastewater management in Ethiopian higher learning institutions: functionality, sustainability and policy context. *Journal of Environmental Planning and Management*, 57, 369-383.
- Haddis, A. (2017). Environmental impacts of the liquid waste from Assalaya Sugar Factory in Rabe k Locality, White Nile State, Sudan. *International Journal of Environment, Agriculture and Biotechnology (IJEAB)*, Vol-2(Issue-4).
- Joshi, A. and Amadi, C. (2013). Impact of water, sanitation, and hygiene interventions on improving health outcomes among school children. *Journal of Environmental and Public Health*, 2013, 984626.
- Kumar, S., 2018. Fundamentals of Environmental Studies for Undergraduate Courses: A Textbook Based on Syllabus.
- Lancet., I. and T., (2018). Findings from the Global Burden of Disease Study 2017. Issue http://www.healthdata.org/sites/default/files/files/policy_report/2019/GBD_2017_Booklet.pdf
- Liu, Y. (2015). Methane emission from sewers. *Science of the Total Environment*. . <https://doi.org/10.1016/j.scitotenv.2015.04.029>, pp. 524–525, 40–51.
- Liyanage, C., (2007). Waste couture: Environmental impact of the clothing industry.
- Lock, Y. A. C. T., (2012). The impact of environmental management systems on financial performance in fashion and textile industries. *Int J Production Econ*, pp. 135: 561-7.
- Loucks, D. P. and Van Beek, E. (2017). Water resources planning and management: An overview. *Water Resource Systems Planning and Management*, 1-49.
- Manderso, T. M. (2018). Overview of existing wastewater management system in case of Debre Markos Town, Ethiopia. *Engineering Mathematics*, 10(9), 23-35.
- McFarland, A. R., Larsen, L., Yeshitella, K., Engida, A. N. et al. (2019). Guide for using green infrastructure in urban environments for stormwater management. *Environmental Science: Water Research and Technology*, 5(4), 643-659.
- McMichael AJ, (2008). Global Environmental Change and health: impacts, inequalities and the health sector. *BMJ: British Med J*, p. 336: 191.
- Menbere MP, M. T., (2019). Industrial Wastes and their management Challenges in Ethiopia. Institution, pp. 11:1-6.

- Mitike G, (2016). Review of policy, regulatory, and organizational frameworks of environment and health in Ethiopia.
- Parween, M. and Ramanathan, A. L. (2019). Wastewater management to environmental materials management. In C.M. Hussain (Ed.) *Handbook of environmental materials management* (pp. 2745-2768). Springer.
- Patel, R., 2015. Health Status and Programmes in India. New Delhi: New Century Publications.
- Prof. Ľudmila Ševčíková, M. P. A. P. Ľ. A. M. P. M., 2015.
- Pirastu, R., Comba, P., Iavarone, I., Zona, A. et al. (2013). Environment and health in contaminated sites: The case of Taranto, Italy. *Journal of Environmental and Public Health*, 2013, Article ID 753719.
- Services, D. (2017). Monthly Newsletter of the National Centre for Disease Control.
- Shah, S. (2021). Impact of industrial pollution on our society. *Pakistan Journal of Science*, Vol. 73 No. 1 (DOI: 10.57041/pjs.v73i1.646).
- Shrestha, N. R. (2018). Human relations and primary health care delivery in rural Nepal: The case of Deurali. *The Professional Geographer*, 40, 202-214.
- Slovin, D. (2017). Assessment of the liquid waste management practice of Condominium Houses in AddisAbaba Ethiopia. *Int J Innovative Res and Develop*, pp. 7: 214-20.
- Tafere Y, (2014). Utilization of environmental health services of urban health extension program and associated factors in Debretabor town, North West Ethiopia: cross sectional study. *Volume Sci J PublicHealth Vol*, pp. 2:494-501.
- Van Rooijen, D. (2017). Global environmental problems, environmental safety and Global Environmental problems, environmental safety and. PP.186-98.
- Van der Byl CA, S. N., 2015. Embracing tensions in Corporate Sustainability. A review of research from wins and trade-offs to paradoxes and beyond. , pp. 54-79.

Appendix 1: Survey Questionnaire

Dear participant, first of all I appreciate your willingness to participate in this study questionnaire. My name is Belachew Dafursa, I came from Madda Walabu University, I am student of environmental science (specialization in environmental pollution and sanitation). I am conducting research assessment of environmental and public health impacts associated with the liquid waste disposal practices from food processing factory in Wondo Genet Bussa Kebele, Oromia Regional State, Ethiopia. I would like to ask you question about knowledge, altitude and practice of liquid waste disposal practices from food processing and its associated factors. Whatever information you provide I will be kept carefully private and will not be shown to other persons. Participation in this research is voluntary and you can decide not to answer any or all of the questions. If you don't recognize any of the questions, please ask me for more explanation. I expect that you will participate in this survey since your views are vital for this study.

Thank you for your valuable time!

Part I: Socio-demographic Related Information's

Questions	Response
What is sex of the respondent?	1) Male 2) Female
What is age of the respondent (in completed year)?	-----years
What is religion of the respondent?	1) Catholic 2) protestant 3) orthodox 4) Muslimism 5) No religion
What is marital status of the respondent?	1) Married 2) un married 3) Divorced 4) Windowed
What is educational status of the household head?	1) Illiterate (cannot read and write) 2) Only read and write 3) primary school level (1-6 grade) 4) Junior secondary (7-8 grade) 5) secondary high school level (9 -12 grade) 6) Diploma holder 7) First degree holder
What is the job of household?	1) Farming only 2) Farming and Merchant 3) Other job (specify)
What is monthly income of households?	_____ Birr
How many the household sizes? (How many people live in the house?)	_____ individuals
Occupation	Employed (private and government) Housewife Retiree Student Farmer Other

Part II. Liquid waste practices, types and components of liquid waste and factors affecting households' liquid waste practices in town households

Questions	Response
Do you know what waste mean	1.Yes 2. No
What do you think of liquid waste? Do you think of liquid waste are:	1. Useless 2. Useful 3. Somewhat useful
Do you agree with the importance of liquid waste disposal in the wondo genet town particularly Busa Kebele	1. Yes 2. No

How often do factory dispose liquid waste?	1. Every day 2. Every third day 3. Every five day 4. Once in a month
Do factory have a temporary liquid waste storage?	1. Yes 2. No
If your answer is for above question is "Yes". what materials do factory use to	_____, _____, _____
Is liquid waste disposing container available in your neighborhood?	1. Yes 2. No
Do your temporary storage liquid waste in your house	1. Yes 2. No
Do you separate liquid wastes before dumping	1. Yes 2. No
Do you store liquid waste generated from your house until solid waste	1. Yes 2. No
Do you dump liquid waste in open spaces	1. Yes 2. No
Do you dispose liquid waste on road side	1. Yes 2. No
Do your disposal liquid waste in the yard	1. Yes 2. No
Do your disposal liquid waste in to the drains	1. Yes 2. No
Do you segregate liquid waste at your home	1. Yes 2. No
Did you practice source reduction strategy	

Part III: Socio economic- related factors of liquid waste disposal practices

Questions	Response
Distance of house from main roads	1. 0-200m 2. Greater than 200m
Are there waste bin/container in neighbor hood	1. Yes 2. No
Are you willing to pay for the solid waste collector's service in order to improve liquid waste disposal practice	1. Yes 2. No

Part IV: Institutional- related factors of liquid waste disposal practices

Questions	Response
Do you know that there are rules and regulations of liquid wastes in Wondo genet Town Busa Kebele?	1. Yes 2. No
Rules and regulations enforcement on liquid Waste disposal in Wondo Genet town?	1. None at all 2. Regulation is weak 3. Regulation is strong
Have you ever seen when violators of regulation in liquid waste disposal are penalized?	1. Yes 2. No

Does Access to door-to-door collection service?	1. Yes 2. No
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Part V: Potential public health risks associated factor affecting liquid waste disposal practices

Factors	Factors level				
	Very Strongly	Strongly	Average	Less Influence	No Influence
Poor Coordination					
Financial shortage					
Lack of rules and regulations					
Lack of initiative					
Unreliable service					
Dumping site problems					
Lack of awareness					
Lack of containers					
High resource consumption					

Part VI: Variables Information

Community Awareness	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Community has active awareness of liquid waste disposal practices					
Importance of liquid waste disposal practices					
Importance and benefits of liquid waste disposal practices to environment					
Roles of community on liquid waste disposal practices					
Policies and Guidelines of liquid waste disposal practices					
Surrounding Environmental Impact	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Do you get involved in trying to solve environmental problems					
How well do you think the environment can recover on its from problems caused by humans?					
the way of liquid waste reduces the damage you cause to the environment					
We can all do our bit to reduce the effects of climate change					
Nothing I do on a daily basis contributes to the problem of climate change					

Disposal management practices in the factory	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The practice of Proper Segregation					
The practice of Proper Recycling					
The practice of Proper transporting					
The practice of Proper Disposing					
Cost for liquid waste					
Should the factor provide more money to support liquid waste disposal practices					
Do the factory pay container fees for municipal					
You don't want to pay					
Do the factory charge per month for waste collection					
Costs is the main reason for your level of satisfaction					
Distance of dump site	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Uncontrolled burning of waste in open dumpsite could result air pollution					
There are enough garbage receptacles in major Towns					
Garbage truck cause some leakage of leachate or trash in to the road					
Garbage truck led to noise pollution that cause annoyance					
Concerned distance Dumpsite has impact to health problem for collection					
Implementation of liquid waste disposal	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Liquid waste disposal practices are available all working time					
Management has commitment to implement the Liquid waste disposal practices					
The training is held in the proper order and level of trainees understanding					
Employees have active participation of the Implementation of the liquid waste disposal practices					
Employees have commitment to accept implementation of liquid waste disposal practices					
Same issue with high frequency of support request are solved permanently					

Thank you in advance for your cooperation!

Appendix II

Interview prepared for member of municipality, factory managers, local leaders and health offices

Dear respondents, I would like to inform you that this interview is for academic purpose only, which is to collect information for MA Thesis entitled assessment of environmental and public health impacts associated with the liquid waste disposal practices from food processing factory in Wondo Bussa Kebele.

The outcomes of this study may help the efforts made by the responsible bodies to find ways of improving liquid waste disposal practices in the town. As one of the stakeholders your views and ideas are considered very important for the success of this study and it would be very much appreciated if you spend a little time to answer these questions.

1. What types of liquid waste are generated in the Busa Kebele? Or what are the common types of waste generated in the Kebele?
2. What types of liquid waste are generated in the food processing factory?
3. Can you describe the current disposal practices for liquid waste?
4. What measures are in place to prevent contamination of local water sources?
5. Are there any recycling or reuse practices in place for liquid waste?
6. How does the factory plan to improve its waste management practices in the future?

Thank you in advance for your cooperation!

Appendix III

Focus Group discussions for micro and small enterprises

1. What are your perceptions of the current liquid waste disposal practices at the food processing factory in our community?
2. In what ways do you believe liquid waste disposal practices have affected local water quality and ecosystem health?
3. Have you or your community experienced any health issues that you think might be linked to the liquid waste from the food processing factory?
4. What information or resources do you believe are necessary for the community to better understand the impacts of liquid waste disposal?
5. What recommendations would you suggest for improving the liquid waste disposal practices at the food processing factory to protect both the environment and public health?

Thank you in advance for your cooperation!