CENTER FOR ENVIRONMENT AND SUSTAINABLE DEVELOPMENT, COLLEGE OF DEVELOPMENT STUDIES

WASTE MANAGEMENT PRACTICES OF BURAYU ABATTOIR AND ITS IMPACTS ON SURROUNDING COMMUNITY IN BURAYU TOWN, OROMIYA REGION, ETHIOPIA

BY

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Declaration

I, **Mamo Abdi** , do hereby declare to Addis Ababa University School of Graduate Studies that this thesis is a product of my original research work, and it has not been submitted to any other university for any academic degree. Materials and information other than my own are dually acknowledged.

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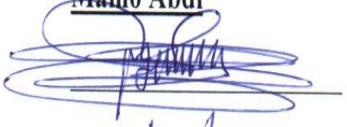
Signature: 

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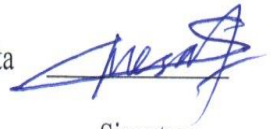
Dr. Mesay Mulugeta  8/07/2021

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As supervisors/co-advisers of the thesis, we certify that, we have read and evaluated the thesis proposal prepared by **Mamo Abdi** 'entitled *Waste Management Practices of Burayu Abattoir and Its impact on surrounding Community in Burayu Town, Oromia Region, Central Ethiopia* `and recommend for Open Defense as fulfilling the requirement for the degree of **Master of Science in Environment and Sustainable Development Studies.**

As members of the Examining Board of the Thesis Open Defense, we certify that we have read and evaluated the thesis proposal prepared by **Mamo Abdi** "entitled *Waste Management Practices of Burayu Abattoir and Its impact on Surrounding Community in Burayu Town, Oromia Region, Central Ethiopia*` and recommend that it is acceptable as a proposal for the thesis required for the degree of Master of Science Degree in Environment and Sustainable Development Studies. Signed by the examining committee:

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Definition of key words

Abattoir is defined as any premises that is approved and registered by the controlling authority in which animals are slaughtered and dressed for human consumption (Lawan *et al.*, 2013).

Waste: can be defined to include any solid material or material that is suspended, dissolved, and transported in water (including sediments and which is spilled or deposited on land or into water resource) in such volume, composition or manner as to cause or to be reasonably likely to cause the water sources to be polluted (Nazif, 2014). Adedipe (2002), defines waste as any matter, whether gaseous, liquid or solid or combination which is from time to time designated by the minister by notice in the gazette as any undesirable or superfluous by-product, emission, residue or remainder of any process or activity. Based on the above definition of waste given, waste can be in any form whether liquid, gaseous, or solid

Abattoir waste generated as the result of abattoir operations is one of the greatest general environmental threat, this is because they actually pollute all phases of the environment namely land, water and air. Wastes emanating from slaughtered animals are basically in solid and liquid states. However, the gases and the odor emitted from putrefying wastes become very offensive to the nostrils, and can sometimes be source of localized air pollution. (Alonge, 2005)

Waste management as defined by Veterinary Dictionary (2014) defines as the systematic administrations of activities provided for the collection, transportation and processing of wastes. Proper waste management is a desirable asset for human health and it recognizes the need for each individual to participate in the improvement of wastes management, because poor waste management contribute to contamination of the environment and pollution (liquid, gaseous, solid), spread of insects like mosquitoes, flies and many other vectors and pathogens of infections. All these can be easily controlled and prevented through a proper waste management.

Waste management practices: are good abattoir housekeeping, abattoir waste management should be progressively implemented commencing with low cost, low technology practices and thereafter progressing to more sophisticated technologies (GDARD, 2009). Liquid and solid waste products including specific risk material from the slaughter operation need to be handled, transported and disposed of in compliance with relevant regulations and in a manner appropriate for each processing site. There exist, however, a number of good management practices which, when applied in terms of pre-treatment, can lessen the environmental impact

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of abattoir waste and potentially increase the availability of value-added products (Adeyemi. and Adeyemo, 2007)

Environmental pollution is one of the significant international concerns today. Various emerging pollutants in the environment such as persistence organic pollutants, nanomaterial's pollutants, micro plastics, radioactive pollutants, and heavy metals display harmful effects on the human body, animals, and plants. The main types of environmental pollution that lead to harmful effects today are water pollution, soil pollution, and air pollution (Allahabad, 2002).

Paunch Manure: in ruminants, the first stomach or paunch contains undigested materials or paunch manure. The paunch manure could have a moisture content of about 88% with an average of 177,300mg/l, and average BOD of 50,200mg/l. The solid portion of the paunch manure contains the greatest pollution load, about 73% of the COD and 40% of the BOD. Improper disposal of paunch manure can therefore exert oxygen demand on the receiving environment or breed large population of decomposers (micro-organism) some of which may be pathogenic (Onunkwo *et al*, 2011).

Abattoir Effluents: are mainly composed of diluted blood, fat and suspended solids. It may also contain some coarse solids e.g. manure, pieces of meat etc. Generally, fresh abattoir effluent has been shown to contain solids, minerals, metals, and micro-organisms; and to exert oxygen demand. On the other hand, aged and decomposing abattoir effluent is often malodorous (Onunkwo *et al*, 2011).

Animal Horns and Bones: when not disposed of properly are unsightly; they occupy useful space; are odorous and attract flies, and can cause nuisance (Ezeoha *et al*, 2011).

Animal Faeces or Manure: the faeces of livestock has been observed to consist of undigested food, mostly cellulose-fibre, undigested protein, excess nitrogen from digested protein, residue from digested fluids, waste mineral matter, worn-out cells from intestinal linings, mucus, bacteria, and foreign matter such as dirt consumed , calcium, magnesium, iron, phosphorus, sodium, etc. Improper disposal of animal faeces can therefore Cause oxygen-depletion in the receiving environment. It can also cause nutrient-over enrichment of the receiving system. And the possibility of disease causation is also present (Ezeoha *et al*, 2011).

Decomposing Manure Pile: the abattoirs in Nigeria; both the paunch manure and the animal faeces are allowed to pile up and decomposed without paying necessary attention. Such manure piles are permanent sources of pollution within the market environment, as they are often foul-smelling, attract both flies and scavengers, and breed mosquitoes (Nwanta *et al*, 2011).

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Abbreviations

AGPLMD	Agricultural Growth Program Livestock Market Development
BOD	Bio-chemical Oxygen Demand
BSE	Bovine Spongiform Encephalopathy
COD	Chemical oxygen Demand
DAF	Dissolved Air Floatation
GDARD	Guideline from Department of Agricultural and Rural Development
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPE	Environmental Policy of Ethiopia
FGD	Focus Group Discussions
IDP	Integrated Development Plan
KII	Key Informant Interviews
MDS	Multidimensional scaling
WMT	Waste Management Theory
MoLF	Ministry of Livestock and Fisheries
MoUDH	Ministry of Urban Development & Housing
MSW	Municipal Solid Waste
NGO	Non-Governmental Organization
ONRS	Oromia National Regional States
PLC	Private limited company
SBPDA	Sanitation, Beautification and Park Development Agency
SOPS	Standard Operating Procedures
SPSS	Statistical Packages for Social Sciences
SWM	Solid Waste Management
UIIDP	Urban Institutional and Infrastructure Development Program

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Abstract

The study was intended to assess waste management practices of Burayu plc abattoir and its impacts on surrounding community in Burayu town, Oromia Regional state, Ethiopia in 2019. The research design used was descriptive research design to agree on the waste management practices of Burayu abattoir. This design offers to the researchers a profile of described relevant aspects of the phenomena of interest from an individual, organizational, and industry-oriented perspective. Burayu plc.abattoir was selected purposively based on the availability of abattoir and its severity impact on the environment. As to assess its impact on surrounding community, Gafarsa Burayu and Keta Burayu kebeles was selected purposively based on their proximity to the abattoir. For this study a total of 330 households were selected using random sampling method. The selected sample households were interviewed using structured questioners and focus group discussion, key informant interview and field observation were also used to collect the data. The collected data were analysed using SPSS version 20 software. The data revealed that about 158 (47.9%) of household respondents surrounding the abattoir was strongly disagreed with the presence of abattoir in their vicinity. As study result indicated the abattoir wastes were directly discharged to Burayu River and residential areas without considering environmental pollution. As a result about 48.2%, 36.4% and 42.7% of the respondents agreed as the local community in the area was suffering with the prevalence of difficulty in breathing diseases, coughing and asthma disease respectively as a result of poor abattoir waste management. Developing comprehensive management system for abattoir waste including blood wastes can be further utilized as blood meal, wastewater can be treated and reused for greenery, irrigation and cleaning purposes and intestinal contents can be used for biogas generation and the derived from it also used for natural fertilizer to reduce environmental pollution and public health issues.

Keywords: *Abattoir; waste management practices; impact; environmental pollution*

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CHAPTER ONE: INTRODUCTION

1.1. Background

The slaughtering of animals for community consumption is inevitable in most nations of the world and dates back to antiquity. The existence of public abattoirs has been traced to the 15th and 16th centuries, in Italy and France, where abattoirs were among the public facilities provided by the State (Edwards *et al.,* 1979). Edwards *et al.,* (1979) state that in Nigeria, nearly every town and neighborhood is provided with a slaughter house or slaughter slab. They further observe that abattoirs may be situated in urban, rural and nominated industrial sites, and that each has advantages and disadvantages.

Ethiopia has the largest livestock population in Africa, with an estimated 59.5 million cattle, 30.2 million goats and 30.7 million sheep (CSA, 2017). In Ethiopia, the demand for meat supply is increasing over time as a result of increasing human population coupled with expanding urbanization and higher average income of the consumers. To meet this demand, millions of animals are slaughtered every year throughout the country. It has been indicated that in 2007 a total of 18.8 million cattle, sheep, goats and camels were slaughtered at government and private slaughterhouses, mostly for local consumption (FAO, 2009a).

The growing demands on meat in the country led to expansion of abattoir industries as municipal and private abattoir throughout the country. According to LDP (2016) report there is about 296 abattoirs in Ethiopia. Among these, most of the abattoirs are long-standing. Apart from these some newer abattoirs established in different standard towns of the country, most other abattoirs are in a state of disrepair, and their physical, sanitary and operational condition are very poor (AGPLMD, 2016). Accordingly, about 94% of these older abattoirs are located in the inner city or town, where expansion and safe waste disposal are no longer possible (AGPLMD, 2016). However, with increasing meat consumption, the risks of disease, and the need to ensure proper waste disposal has resulted in urgent need of relocating many abattoirs in non-residential locations. This is to adhere to the modern structural requirements of abattoirs, hygiene management practices and environmental compliance.

MoLF and MoUDH, (2016) has designed standard abattoirs that comply with the standard and level of towns. The abattoir standard set has been followed by standard operating procedures (SOPs). Despite the set standard to maintain quality and safe abattoir service in the country,

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municipal abattoirs are suffering from limited public sector financial capital for construction and/or upgrade in adequate technical capacities to run the services. Although municipalities have a responsibility for ensuring safe meat product, the reality indicates the inverse. Unlike the public abattoir services, the abattoirs operated under the private ownership relatively shows standard physical structures. However their operations are under keen monitory and control authorities of the municipality and the ministry. The partnership between the public regulatory authorities and the private owners need to be extended to the physical construction of abattoirs as well. This type of partnership is assumed to ensure high quality service of the abattoirs. The current practice shows that, the government ensures standard construction & services, through regular monitor and enforcement. Within this arrangement, good hygiene practices & environmental protection can be emphasized (MoLF, 2016).

Like other towns of the country, Burayu town has two abattoirs one owned by municipality & the other one is private limited company. The current situations of both abattoirs are at risk since they are found proximate to residential area and they are environmentally sensitive. Both abattoirs directly release waste products to the near-by river. This is assumed to create environmental effect which in turn has negative impact on environment, human and animal health. The problem becomes more sensitive in times when there is loose control by authorities. The uncontrolled waste products emissions and unsafe sanitary condition of the abattoir facilities necessitates a continued complain by the surrounding community due to its multifaceted negative effect on their health as well as welfare of the communities. This ground of reality about the abattoirs waste management and its associated impact on the surrounding community has appeared to be an important research problem. Due to applicable laws and regulations signed between the owner and the regulatory body, this research opted to be conducted on the private abattoir company. Despite the purposive selection of the abattoir from the public operated abattoir, the impact may be applicable for both types.

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1.2. Statement of the problem

Abattoir waste can be defined as wastes from slaughterhouse which could consist of the pollutants such as animal faeces, blood, fat, animal trimmings, paunch content and urine (Leon-Guidelines, 2001). It has been reported that discharge of large quantities of wastewater is common environmental issue to all slaughterhouses (Cowi, 2001). It is also reported that surface water bodies in developing countries are under serious threat as a result of indiscriminate discharge of polluted effluents from industrial, agricultural, and domestic activities (Kambole, 2003).The abattoir waste affects air quality, agriculture, potable water supplies and aquatic life. These all pose risks to human health (Adeyemi and Adeyemo, 2007). The abattoir is major polluters to the environment and especially rivers due to release of effluents (Rotich *et al.*, 2006). Abattoir activities provide a highly suspended solid and liquid which consists of pollutants such as animal faeces, blood, fat, animal trimming, paunch content and urine. Consequently, mismanagement of this abattoir has detrimental impact on the environment, public health, animal health and economy of the country.

The review of existing literature revealed that there were numerous research works conducted in different parts of the country that focused on the municipality waste management practices (Rotich *et al.*, 2006; Kambole, 2003; Chukwu *et al.*, 2011). But there was no, research done on all type of abattoir waste (solid, liquid and gaseous) management practices and municipality waste different from abattoir waste. Like other towns of the country, Burayu plc.slaughters 550 of live animals per day. The current situations of the abattoirs are at risk since it is found proximate to the residential area and assumed to be environmentally sensitive. The abattoir release all waste products to the near-by river (Burayu River) have negative impact on the surrounding community health. However, waste management practices of Burayu plc.abattoir and its impacts on surrounding community at Burayu town were not yet studied. Therefore this research was attempted to assess abattoir waste management practice and its impact on surrounding community in Burayu town.

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1.3. Objectives of the study

1.3.1. General objective

The general objective of the study was to assess the waste management practices of Burayu abattoir and its impacts on surrounding community in study area.

1.3.2. Specific objectives

More specifically, the study aspires to:

identify the demographic area of the study area

investigate the perception of communities on the impacts of Burayu abattoir on surrounding community

assess the waste management practices that is under taking in relation to standard/ regulations of the country

assess health impacts of abattoir waste on the community

1.4. Research questions

This research intended to answer the following basic questions which were derivatives of the above mentioned research objectives:

What is the abattoir area demography looks like?

How do the surrounding communities perceive the abattoir waste management activities?

How much law and regulation was implemented in Burayu abattoir waste?

What are the abattoir waste management practices under taken in the study area?

Does the abattoir waste disposal practices affect the health of the community?

1.5. Limitation of the study

The understanding of the respondents on the abattoir waste management practices and impact of the waste disposal might vary according to their experience in the areas. This might limit the scope of the study implying on generalization of the findings. The other limitation might be with regard to an expected Covid-19 cases (coronavirus diseases) influenced on data collection and an availability of well-organized data (secondary data) from respective relevant government organizations and/or institutions. Time and financial resource remains the key challenge to the study.

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1.6. Scope of the study

\The study has limited spatial scope i.e. Burayu plc abattoir. The study area was selected purposively. The study considers only community live proximity to the abattoir

1.7. Significance of the study

The result of this study used as an important input for the government institutions working in and around Burayu abattoir to consider the waste management issues in their annual and short strategic plan of development endeavor. In doing this the target beneficiary community might get more efficient services in their respective locality (improved health, and other facilities). The result of this research will bring a significant understanding about the impacts and management practices of abattoir wastes to the whole stakeholders. Furthermore, the output of this study also believed to given an insight to the health sector, policy makers, researchers and the society with regards to the impacts and management practices of abattoir on Burayu town and the surrounding communities to bring effective solutions

The study was believed to have significance in contributing to the body of knowledge as well as improved practices in waste management to the extent of delivering effective policy framework. The finding supplements existing knowledge by adding the real practice of waste management in the study area. This would be ensured by sharing the finding on relevant forum and distribution of articles. The policy sector would make use of the findings to improve the public health, environmental pollution, animal health, management practices and policies. It would specifically service the policy in providing key lessons and recommendations for improvement in abattoir waste management that in turn had a positive contribution to improved community health. Again, through this research work, the student/ /researcher would get a lot of knowledge & experiences to make further research

1.8. The research ethics

In case of data collection, ethical considerations were seriously taken to ensure the protection, integrity, anonymity, consents and other human elements of the informants. In this research paper the ethical clearance that considered are whether this research is funded and its sources, that it is project, the way this research is conducted in person or remotely, whether the information was collected directly, about publication of this research, whether the research for acquiring knowledge, similarity with other project that could be approved elsewhere and that it

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has received ethical permission for the research or not. Particularly, as per the guarantee that was made to my research respondents; the research problem has a rational for its importance, the utility to the area in particular and to the nation at large. In general the respondents will not identified by names, their consent was required during interview, discussions and the respondents' privacy and their responses were not individually analysed and included in the final report.

1.9. Organization of the study

This thesis is organized in five major chapters. The first chapter included introduction, statement of the problem, objectives of the study, significant of the study and scope and limitations of the study. The second part deals with literature review that includes conceptual and theoretical frameworks of abattoir and empirical studies made in the country and elsewhere in the world. The third chapter presents description of the study areas and methodologies used for the study. The fourth chapter contains the research results and discussions that are emanated from the first and secondary data sources. Finally, chapter five presents conclusion and recommendations that are drawn from the study

CHAPTER TWO: RELATED LITERATURE REVIEWR

2.1 Theoretical review

2.1.1 Waste management theory

Theories were constructs body of knowledge that helps to explain systems of regularities that cannot be explained with scientific laws (Hempel, 1966). Formally, a scientific theory may be considered as a set of sentences expressed in terms of a specific vocabulary.

Pongracz *et al.,* (2004) states Waste Management Theory (WMT) as it has been introduced to channel environmental sciences into engineering design. WMT is a unified body of knowledge about waste and waste management. It is an effort to organize the diverse variables of the waste management system as it stands today. WMT is considered within the paradigm of Industrial Ecology, and built side-by-side with other relevant theories, most notably Design Theory (Love, 2002). Design Theory is a relatively, still under development. Following its development offers valuable insights about evolving technical theories. According to Love (2002), it is crucial to development theory to integrate with other bodies of knowledge, as well as the clarification of the definitions of core concepts, and mapping out key issues, such as domains, epistemologies and ontologies. At the present stage of WMT development, scientific definitions of key concepts have been offered, and evolving of WMT under the paradigm of Industrial Ecology is in progress.

According to Pongracz and Pohjola (1997), there are four classes of waste that demands specific level and strategy of treating. Based on this fact Waste class one describes none-wanted things, created not intended, or not avoided, with no purpose; waste class two describes things, created not intended, or not avoided, with no purpose; waste class three describes things with well-defined purpose, but their performance ceased being acceptable due to a flaw in their Structure or State, and waste class four describes things with well-defined purpose, and acceptable performance, but their users failed to use them for their intended purpose.

According to WMT described above, prevention of waste creation is the main priority of waste management. On the other hand, waste minimization requires the firm commit to increasing the proportion of non-waste leaving the process. It has been argued that, it follows from the laws of thermodynamics, that producing by-products is concomitant with a main product (Baumgärtner & Arons, 2003). For this reason, industrial firms have to look beyond their factory walls, and

seek for external utilization of their waste, in accordance with the principles of Industrial Ecology (IE).

2.1.2 Industrial ecology theory

The Theory of Industrial Ecology (Korhonen, 2004a) found that the description of how the physical flows of materials and energy flow in natural ecosystems can be used for prescription for the vision and the overall goal of industrial ecosystem ecological sustainability. The flows of matter, Base Cation (BC) nutrients, energy and carbon, which are among the most important material and energy flows in terms of sustainability, flow in a totally different way in the global ecosystem than in the global economic or industrial system (Korhonen, 2004a; Korhonen *et al.*, 2001). The ecosystem is sustainable if sustainability means that a system is able to continue its operation forever. The global industrial, economic and societal systems are unsustainable. If sustainability means forever, or at least a very long time, a system where 80% of the energy production relies on nonrenewable and carbon dioxide emission intensive fossil fuels, is not on a sustainable path (not in line with the system condition one above).

The prescription for concrete measures and practical actions for how human actors, policy decision-makers, firms, organizations and individual consumers should act, for what they should do and how should they work in practice in their everyday life to achieve the vision of sustainability is very difficult in industrial ecology. The Theory of Industrial Ecology (Korhonen, 2004a) found that this kind of prescription derived from description of ecosystems is not possible (or very difficult) in human industrial systems. Each individual case, process, firm, network of firms, region or a national economy has different system boundaries. The difference can be due to spatial and temporal difference. In addition, there are other situational conditions, which make each case different from each other. The case specific situational factors include ecological, technical, economic, social and cultural.

If waste minimization and resources use optimization is the most important objective of waste management (Pongrácz, 2002), it is essential that WMT is to be considered together with IE, as resource use optimization considerations reach beyond the tradition scope of waste management. It was argued that there is considerable overlapping between the goals of IE and waste management where waste minimization in concerned. The principles of IE (Graedel and Allenby, 1995) and waste minimization measures (Vancini, 2000) are clearly recognize goals

and principles similar in IE as well as waste minimization. WMT is positioned between other relating theories, and what tools need to be used to achieve the objectives of IE.

The 'world of waste' is emphasized from "Empirical," to highlight the influencing factors on designing waste management. It draws data from the existing waste management infrastructure, and is restricted by its legislative constraints. On the plane of waste management," WMT seeks to optimize resources use from virgin raw material, to discard. The goals, values for resources optimization originate from the paradigm of Industrial Ecology. It was argued that the goals in IE have to be adapted by WMT and to translate the goals of IE so that they are applicable to an industrial unit (Pongrácz, 2004). The majority of tools that are to be adapted to industrial waste management originate in IE; however, some tools are also influenced by Design Theory. Social aspects are also taken into account, principles such as sufficiency, morals and responsibilities will have to be introduced into the goals and values to be followed. From the "real world" surrounding the waste management domain, human needs and expectations also affect the objectives set out by WMT. Finally, theory is continuously developed and updated based on facts, regularities and observations as well as the process of explaining observation and answering domain specific queries.

2.2 Empirical review

Waste generation at slaughter houses poses a serious problem to the environment because of poor handling practices which result into adverse impact on land, air and water. In a typical Nigerian abattoir, the surrounding land is often marshy due to improper channeling of waste water arising from the dressing of the slaughtered animals and washings at the lairage. Land pollution also occurs when solid wastes such as bones, pieces of flesh and dung are left unattended in open spaces. When precipitation takes place, these wastes leave the land in a polluted state while part of it get washed into nearby streams. As noted by Omole (2013) most of Ethiopia abattoirs like Nigerian abattoirs are situated close to surface water bodies in order to have access to water supply needed for slaughtered animal processing and to provide a sink for the run-off from meat processing activities.

Many abattoirs in developing countries dispose of their effluents directly into streams and rivers without any form of treatment and the slaughtered meat is washed by the same water. According to Chukwu *et al.* (2011), little interest has been shown to the effects of wastes from abattoirs to the environment. They further stated that due to low awareness of the effects of abattoirs, it is

very common to see people sinking shallow wells close to them. These shallow wells would draw contaminated water from the surrounding aquifer especially if the radius of influence of the well spans into the abattoir ground (Singh and Neelam, 2011).

Most of the times unknowingly discharge of blood and animal faeces into streams may cause oxygen-depletion as well as nutrient-over enrichment of the receiving system which could cause increased rate of toxin accumulation (Nwachukwu*et et al.*, 2011). Humans may also be affected through outbreak of water borne diseases and other respiratory and chest diseases (Mohammed and Musa, 2012).

The other study conducted in Nigeria also indicated, the waste from the slaughtering and dressing grounds in the abattoir are washed into open drainages untreated and the leachates from the series of decomposition processes of these wastes can introduce enteric pathogens and excess nutrients into the surrounding surface waters and also percolate into the underlying aquifers to contaminate the hand-dug wells which serve the dual purpose of drinking water for the butchers and others working in the abattoir, and the people in the neighborhood. With inadequate slaughtering and disposal facilities, the abattoir has also become a source of infection and pollution, attracting domestic and wild carnivores, rodents and flies, which are vectors of diseases (Akinro *et al.,* 2009)

The research findings by Olowoporoku (2016), on solid waste (condemn meat, undigested ingesta, bones, horns, hairs and aborted fetuses etc.) disposal in slaughterhouses revealed that 13.0% of the slaughterhouses burn their waste, 65.3% dump their waste on vacant land beside the slaughterhouses, 8.7% of the respondents dump their waste in the bush, 13.0% dump their waste in the drainage. Further findings by this author also revealed that all the slaughterhouses sampled dump their solid waste on the vacant land in the premises of the slaughterhouses. Undigested ingesta, dungs, bones and horns comprise major proportion of wastes generated in Nigerian slaughterhouses .This could be responsible for the highly pungent odour, infestation of flies and diseases vectors as a result of heaps of waste around the slaughterhouses. On the frequency of the disposal of solid waste from the slaughter slabs revealed that 93.3% evacuate their solid waste from the slaughter slabs daily while 6.7% clear their solid waste from the slaughter slabs twice in a week (Olowoporoku, 2016)

A study conducted by Sidabalok *et al.* (2019), in Indonesia revealed that the Multidimensional scaling and sustainability validation analysis in ruminant slaughterhouse Analysis result of MDS

method in ruminant slaughterhouse generated the sustainability value of every dimension. Economy, institutional, and technology dimension sustainability status were considered as moderately sustainable with sustainability value of >50 with economy dimension being 56.76, institutional dimension being 53.52, and technology dimension being 56.33. Dimensions on fairly sustainable category were ecology dimension with 46.51 and social dimension with 45.37; thus, efforts are needed to improve sustainability in ecology and social dimension.

The practical research done on the amount and composition of waste in Addis Ababa was by a company named Norconsult A.S in 1982 from Norway. There are estimations by Sanitation, Beautification and Park Development Agency (SBPDA) based on both these data and the realities of the city that could be significant; the estimated amount of waste generated per day is 0.221kg per capita. The main sources of the waste are: household wastes, Hotels, Commercial institutions, industries, hospitals, and street disposals. According to this particular study the percentage share of wastes are 71%, 3%, 9%, 6%1% and 10 % respectively.

2.3 Impact of abattoir on the environment and public health

Slaughterhouse waste just like other wastes can be harmful to aquacultures, animals, humans and the environment if not properly handled and managed. Some slaughter houses are littered with non-meat products and wastes that need to be recycled into useful by-products for further agricultural and other industrial uses. According to Osibanjo and Adie, (2007), report public health risks and nuisance in most slaughter houses spread across markets, producing air, soil and water pollution as well as infestation of flies and other disease vectors.

For sanitization purpose abattoirs use large amount of water in processing operations; this operation produces large amount of waste water. The main environmental problem related with this abattoir wastewater is the large amount of suspended solids and liquid waste as well as unpleasant odor generation (Gauri, 2006). Similarly, Sangodoyin and Agbawhe, (1992) reported that ground water qualities in vicinity of the abattoir were adversely affected by seepage of abattoir effluent as well as water quality of receiving stream that was located away from the abattoir.

The mismanagement of slaughter wastes particularly free discharge of abattoir wastes into waterways, as such practices can introduce enteric pathogens and excess nutrients into surface water. According to Alonge, (1991) and Meadows, (1995) report the abundant wastes produced by abattoir operation not only leads to a substantial challenge to effective environmental

management but also are related with decrease air quality of the environment, potential transferable antimicrobial resistance patterns and several infectious agents that can be pathogenic to human

2.3.1 Liquid waste management practices

In abattoir operation there must be a generation of liquid and solid nature. liquid waste should be washed away by safe potable and constant supply of fresh water at adequate pressure throughout the premises of slaughtering. Accordingly DOH, (1998) reported that drainage lines of abattoirs need to be well constructed and strategically located to be able to properly drain liquid wastes and prevent stagnation that emits foul odor. There are different effluent wastes produced in abattoir. Similarly, Coker *et al., (*2001) suggested that effluent wastes generated from the slaughterhouse is characterized by the presence of a high concentration of whole blood of slaughtered food animals and suspended particles of semi-digested and undigested feeds within the stomach and intestine of slaughtered and dressed food animals. In addition to these, Masse, (2000) indicated that wastewater from slaughter house would be severe and a potential in environmental pollution, thus, it should not be permitted to mix with the municipal drain system without treatments like anaerobic treatment which means the effluent is digested in the absence of oxygen in an enclosed digester; aerobic treatment in which oxygen assists bacterial action to reduce biochemical oxygen demand level and filter press for dewatering of the sludge.

Majority of the abattoirs in the country have inadequate facilities at the slaughter houses and scattered illegal slaughtering of animals, very few slaughter houses collect blood. Uncollected blood discharge in abattoir becomes a severe hygienic problem. In addition, Aniebo *et al.,(*2009) indicated that blood have a characteristics of quick clots, choking drains, septic tanks, etc. and rapidly decomposes serving as an ideal medium for bacterial growth. Thus, management of blood in slaughterhouse is mandatory to maintain the sanitary of the abattoir. Similarly, Bhat and Khan, (2009) suggested that bleeding areas should be clearly identified in the slaughter houses and blood drains and collection should be done immediately so that its full potential could be utilized. GDARD, (2009) also reported contaminated storm water, waste waters and wash waters should be collected in lagoons and aerated and irrigated without any off-site runoff; clean storm water must be kept away from the contaminated areas and directed to the storm water drainage system. All process areas must have concrete floors graded to wash down drains.

2.3.2 Solid waste management practices

In abattoir, like any liquid wastes, there is also a production of solid wastes. The sources of solid waste in abattoirs include animal holding areas, slaughterhouse and processing areas, waste treatment plant, unwanted hide or skin pieces and unwanted carcasses and carcass parts. In abattoir, the solid waste must be kept separately from liquid wastes. Accordingly, Adedipe, (2002), indicated that solid waste should be kept separate from wastewater streams via the use of bucket traps and skips. This decreases the volumetric and organic load on the wastewater treatment stream. At each slaughter house adequate tools should be provided for de-hiding of the animals and also hides and skins should be immediately transported out of the slaughtering area in a closed wheel barrow or similar other devices.

Additionally, RMAA, (2010) reported that the hides and skins should be spread on the floor of the slaughtering area for inspection. Legs, bones, hooves etc. should also be removed immediately from the slaughtering area through a spring load floor chute or closed wheel barrow. The slaughtered animal rumen consists of partially digested feed material eaten by animal before slaughter together with digestive juices and microbial flora. This, rumen content might be either wasted or composted into manure unless it accommodate place. Similarly, Masse,(2000) suggested that the rumen digested feed material together with digestive juices and microbial flora causes solid disposal problem in slaughter house.

In general, proper disposal, burial and incineration of abattoir wastes are used to mitigate the harmful risks of environment and public health related with abattoir solid wastes (Estonilo, 2006).

2.4 Appropriate abattoir waste management practices

Abattoir waste management practices is crucial to minimize environmental pollution. In addition GDARD, (2009) indicated that good abattoir housekeeping, abattoir waste management should be progressively implemented commencing with low cost, low technology practices and thereafter progressing to more sophisticated technologies. Liquid and solid waste products including specific risk material from the slaughter operation need to be handled, transported and disposed of in compliance with relevant regulations and in a manner appropriate for each processing site. Similarly, Adeyemi and Adeyemo, (2007) indicated a number of good management practices which, when applied in terms of pre-treatment, can lessen the

environmental impact of abattoir waste and potentially increase the availability of value-added products.

Abattoir waste management practices require various technology or labour force. Accordingly, Bello and Oyedemi, (2009) indicated that abattoir waste management practices may require additional technology or labour, these practices may include: primary screening to remove any solids or fats, specific risk management separation with appropriately sized screens, fat/oil removal by flotation and skimming. In addition to this, primary settling, blood separation, waste effluent balancing, pH correction (chemical correction), aerobic ponds and also anaerobic lagoons are mentioned.

2.4.1 .Safe disposal, treatment and processing methods

This practice requires appropriate facilities for safely managing the abattoir wastes. Additionally, Adeyemo, (2002) reported that there must be the appropriate facilities to ensure safe disposal of abattoir wastes in a manner that will not constitute a potential hazard to public health, animal health and the environment is considered very essential to be minimized. Often, reusing or recycling by-products reduces waste production. Recovering valuable materials from waste streams can be economically and environmentally sensible. This practices implemented in respecting to rule and regulation of the environment. EPA, (2001) also suggested the government regulations must be followed in all operations done in abattoirs including the construction of the building itself along with the drainage, water supply and waste disposal systems.

2.4.1.1 Burial

In abattoir waste management practices, burial of wastes is one of the safest and common practices at abattoir and farmers level. However, in burial of abattoir wastes valuable nutrients are discarded. These practices must be undertaken following regulatory practices. Additionally, Adedipe, (2002) suggested that primary regulatory restrictions relating to burial of SRM are that the landfill must be covered immediately after use, it must have a means of keeping out wild life and records must be kept of the locations and volumes buried.

2.4.1.2 Controlled incineration

In abattoir waste management practices, incineration of wastes is one of another practice which is practiced at abattoirs level. The incineration of abattoir wastes must be practiced in controlled

manner as to minimize environmental pollution. In addition, Somlyody, (1993) reported controlled Incineration is the burning of waste materials in safe way which requires temperature to reach 850°C or above, for at least 15 minutes and until all organic matter has been reduced to ash. In fact, incineration destroys most pathogens (sterilizes the waste) including the prion responsible for bovine spongiform encephalopathy (BSE).

Incineration reduces volume by approximately 90%-93% and the resultant ash is considered prion-free, as long as the incineration is conducted correctly. Thus, for slaughter waste containing SRM, if the correct burn is achieved, there would be no requirement for permitting in the disposal of the ash to landfill, or for its use as a soil amendment. Raw slaughter waste can have a negative energy value due to the high moisture content. There may be resistance to incinerators by the public and meeting emissions standards can be an obstacle for some incinerators (Somlyody, 1993).

2.4.1.3 Composting

Composting is natural biological decomposition process where aerobic organisms break down materials in the presence of oxygen. According to GDARD, (2009) suggested, the composting of should be done in pits or bunkers instead of stacks and heaps in consideration of environmental and sanitation. Both structures must be roofed or provided with sheds for security against rain.

According to Juhasz and Mihelic, (2007) indicated that many farmers and approximately 15 to 20 abattoirs are currently composting waste. The cost to compost has been estimated to be approximately one-third the cost of rendering. However, the composting process for full carcasses or significant quantities of waste takes several years is labour intensive and may be ineffective in disposing of hides and bones. The permissible uses of the final product the compost are still uncertain and may depend on the nature of the compost. The compost process is effective to break down the waste, kill some pathogens and produce final compost which is relatively safe.

2.4.1.4 Biogas production

Biogas production is one of the abattoir waste management practices which are rarely practiced at abattoir and farmers level. According to Sahlström, (2003) report anaerobic digestion involves the breakdown of materials by organisms in the absence of oxygen within a specialized

containment unit. Anaerobic digestion technology is practicable for the treatment of organic solid slaughterhouse waste to combine material recovery and energy production. Assuming that the operation conditions can be optimized and the process made economically sustainable, anaerobic digestion is fully competitive with other treatment options for the above wastes.

Waste treatment system in the form of anaerobic lagoons facilitates the degradation of organic matter by microorganisms in the absence of oxygen into methane. It is by far the most frequently utilized method of treating wastewater from slaughterhouses. With anaerobic lagoons, wastewater move through the treatment process with the influence of gravity unlike other technologies with pumps, screens, aerators and mixers. Its disadvantages, however, include requirement for a large land area and emission of odor, especially in improperly designed, poorly operated or too small systems. Mosquitoes may also breed in the water. These can be addressed by constructing the lagoon far away and down-wind from populated areas or by covering lagoon cells (PSA, 2008).

Similarly, Adesemoye *et al.,* (2008) indicated at high temperatures, the anaerobic digestion destroys pathogenic bacteria at considerably higher levels than aerobic digestion, when used as part of an integrated waste management system, anaerobic digestion reduces the emission of landfill gas into the atmosphere, anaerobic digestion produces biogas consisting of methane and carbon dioxide.

Additionally, Richards *et al., (*1991) suggested biogas is produced by anaerobic digestion with anaerobic bacteria or fermentation of biodegradable materials such as manure, sewage, municipal waste, green waste, plant material and crops. The embedding of biogas power-plants is the best solution for bio waste utilization. The use of gut contents, manure and solid waste to produce biogas as fuel for heating and lighting would alleviate shortage of fuel and conserve environment.

2.4.1.5 Blood processing as animal feed

Blood processing is one of the valuable waste management practices which are commonly practiced in the country. Blood is a rich source of iron and proteins of high nutritional and functional quality. Because of the high protein content of blood, generally about 18% of it sometimes referred to as liquid protein. Thus, a valuable protein source is lost if animal blood is discarded as waste. Many countries require that animal blood be disposed of in an environmentally friendly manner, which is a capital intensive process. Accordingly, to eliminate

a sizeable pollution hazard and prevent the loss of a valuable protein source, efforts have been made to ensure the utilization of animal blood on a massive scale. According to Ockerman and Hansen, (2000) indicated a further incentive is the increased profits to be made through adding value to the blood.

When processed and incorporated in the livestock feeds, it would provide a valuable source of animal protein and as a fertilizer it would enrich the soil. The blood available from the slaughter houses should be collected and made use of in pharmaceutical industry. Similarly, Massé and Masse, (2000) reported blood collection on efficient lines will be possible only in modern slaughter houses as collection has to be done speedily only and without dilution with water. Otherwise processing would be pronged making moisture removal highly expensive.

According to Aniebo *et al.,* (2009) suggested by passing steam directly in to blood, allow it to dry and pulverize into a meal is simple method of preparing blood meal. Blood meal is a dry, inert powder made from blood used as a high-nitrogen fertilizer and a high protein animal feed. N = 13.25%, P = 1.0%, K = 0.6%. It is one of the highest non-synthetic sources of nitrogen. It usually comes from cattle as a slaughterhouse by-product (Aniebo *et al.,* 2009).

2.5 Waste management practices in relation to standards /law and regulations of the country

Location of slaughter houses in the city should be properly decided, as any wrong location can cause the various problems in the vicinity. The policies of government regarding zoning should be strictly followed. Singh *et al.,* (2014) suggested that the municipality and local government should properly plans for location of slaughter houses. Effluent from the slaughter houses is a major source of pollution, this water if not disposed properly then causes various health & Environmental issues. Similarly, Singh *et al.,* (2014) suggested that there should be a controlled system of liquid waste collection in the premises slaughter houses.

Additionally, Ogbomida *et al.,* (2016) suggested appropriate wastewater treatment procedures for slaughterhouse in order to prevent the contamination of the environment including surface and ground water. Cost effective implementation of technology & management approaches i.e separation by screening (solids), protein recovery (blood separation), primary settling etc. should be carried out to reduce the period of delayed degradation.

Mulu *et al.,* (2015) concluded that there should also be an intervention of appropriate regulatory bodies (EPA) to control environmental issues related to slaughter houses. As a result of poor free

discharge of abattoir waste to environment, the soil dwelling pathogens were found in the soil around Kara slaughter house but this is not in Odo-Eran slaughter house (Kayode (2014). In addition to free discharge of wastes, there is a difference in construction design of slaughter houses. In Odo-Eran slaughter house roads are properly tarred and proper drainage systems were constructed. People that are consuming meat must have awareness regarding the quality of meat available in market. Also the slaughterer should maintain the quality of meat by maintaining hygienic conditions at slaughter houses. Accordingly, Singh *et al.*, (2014) concluded that the governments enforcing the present by laws strictly related to slaughter houses propose to applicable and a proper licensing system for slaughter houses help in discouraging the unfair means towards it.

Slaughterhouses due to lack of their poor management and planning could badly affect the public health and environment. There should be a strict policy regarding environmental management by regulatory authorities for slaughter houses. Besides Salmonella and Shigella species are common pathogen for human health, signed when contaminated food with the suitable strain is ingested resulting in food poisoning. It has been examined meat, meat products, eggs and poultry are the most common food vehicles to humans (Kayode, 2014).

The Environmental Policy of Ethiopia (EPE), which was approved on April 1997, constitutes eleven-sectoral and eleven cross-sectoral policy elements. Its overall policy goal is "to improve and enhance the health and quality of life of all Ethiopians, and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole, so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs.

Proclamation No.299/2002, enacted in 2002, empowered the EPA to prepare procedure, regulations, guidelines and standards to effectively implement and enforce EIA proclamation.

Environmental guidelines are among the tools for facilitating the inclusion of environmental issues and principles of sustainable development into development proposals. To guide mainstreaming of the principles of sustainability into sectoral projects, sectoral environmental impact assessment guidelines such as gridlines on agriculture, transport, industry, tannery and settlements have been prepared. Proclamation 300/2002, Environmental Pollution Control requires developmental activities to consider environmental impacts before their establishment. The proclamation requires on going activities to implement measures that reduce the degree of

pollution to a set limit or quality standard. Thus, one of the dictates of the proclamation is to ensure, through inspection, the compliance of on-going activities with the standards and regulations of the country through an environmental audit.

Proclamation 295/2002, Establishment of Environmental Protection Organs establishes the organizational requirements and identifies the need to establish a system that enables coordinated but differentiated responsibilities of environmental protection agencies at federal and regional levels. The proclamation indicates duties of different administrative levels responsible for applying federal law.

Proclamation 159/2008, Prevention of Industrial Pollution Regulation as a follow up to Proclamation 300/2002, this regulation to prevent industrial pollution was developed by the Federal Environmental Protection Authority to ensure compatibility of industrial development with environmental conservation. This Proclamation includes comprehensive industrial pollution standards for a range of industrial and mining activities.

2.6 Conceptual framework

The conceptual framework for this research is illustrated in the following Figure 2.1. The figure depicts that the impacts of abattoir wastes on environment are interconnected and various in number. These discharge of effluent, solid wastes and emission of greenhouse gases. These activities result in changes in environmental pollution. The conceptual framework also indicates that climate change results in several adverse socioeconomic and biophysical conditions such as Surface water contamination, ground water contamination, air born disease, water born disease and air pollution. As shown in the framework, the harmful impacts of these adverse factors are environmental pollution which causes social, economic, and environmental and public health problems. It further results in further impoverishments and sufferings which are often manifested in prevalence of different diseases that affect the health of local communities. These changes can be resolved through proper implementation of integrated abattoir waste management practice adoption strategies and technologies which include, waste collection, transport, treatment, processing, recycling or disposal and monitoring of abattoir waste materials. The waste material produced by human activity is generally undertaken to reduce their effects on economy, health, and the environment. The conceptual framework depicts the fact that the favourable impacts of waste management practices benefit to improve the environment, agriculture, potable water, animal health and public health of the community such as biogas, irrigation, animal feed and Compost. These, in turn, improve and create environmental health for living standard.

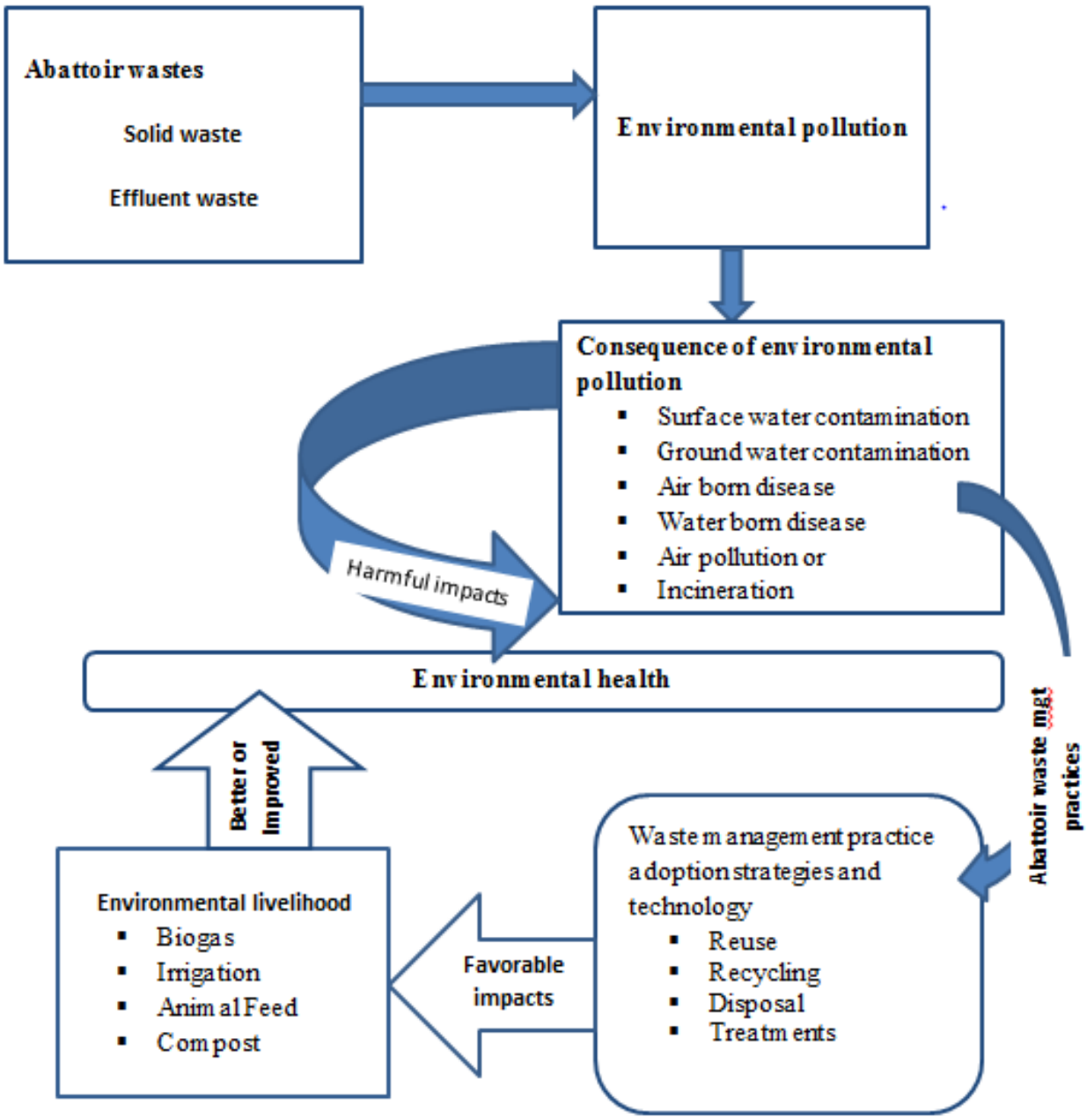

Figure 3. 1**:** Conceptual framework of the study

Source: Own construction based on empirical fieldwork data; FAO /2016/ and other literatures

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA AND THE RESEARCH METHODS

3.1 Description of the study area

The study area (Burayu town) is located from 9°01’00’’ to 9°6’00’’ N latitude and 38°36’00’’ to 38°42’00’’ E longitudes. It is bounded by Finfinne City in the East and South East, forest owned by Addis Baha in the North, Sululta town in the North East, Menagesha Kolobo town in the West, Sebeta-Hawas district in the South. Burayu town is currently structured and administrated under Oromia Special Zone Surrounding Finfinne in the Oromia National Regional State (ONRS). The city was among the 1st level urban center in the region (GIS, 2005).

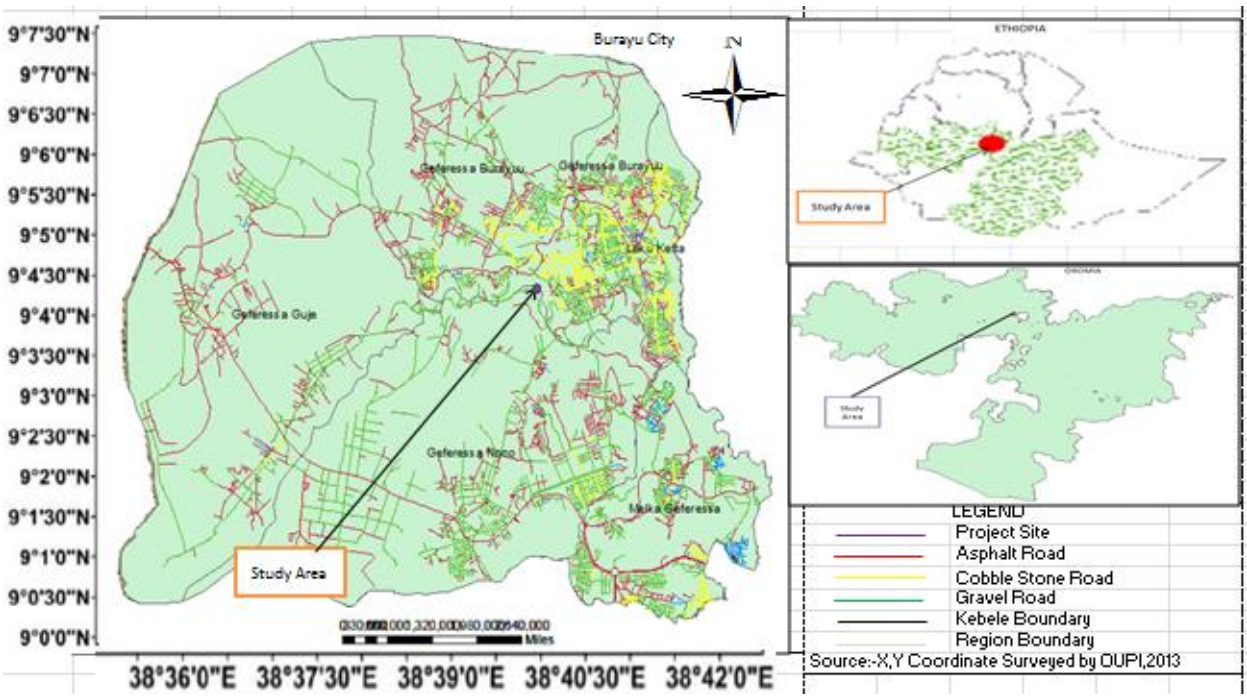

Figure 3. 2: Aerial map of the study area (source: GIS, 2005)

Dispersed type of urban settlement characterizes physical morphology of Burayu town constituting six *kebeles;* Leku-Keta, Burayu-Keta, Gefersa Burayu, Melka-Gefersa, Gefersa Nono, Gefersa-Guje kebeles. The total population of Burayu twon is estimated to be 375, 349 of which 199,013are male &176,336 female (projected from 2007 national census). The numbers of household were also male 42,495 female 8676 and total 51,171live in six vast *kebeles.*

The existing built up area (the developed part of the town) incorporate 6650 hectare of land and recently 2407 hectare is added to the existing. Therefore, the total area included as administration boundary of the town was reckoned to be 9057 hectare. The vastness area of the town boundary has forced to propose one main center around Burayu town Administration Office and three sub centers around Keta, Guje (kella) and Nono (Ashewameda) localities. The selection of center and sub center considers emerging businesses & services and physical radius. Urban center refers to portion of urban center that serves the surrounding area in offering essential urban services. The mean annual temperature, the mean annual maximum and the mean annual minimum temperatures of the town was reckoned to be about 14℃, 22℃ and 6℃, respectively, which was the characteristic of a warm temperate climate, (source: metrological agency)

3.2 Research methods

3.2.1 Study design and approach

The research design used was descriptive research design to agree on the waste management practices of Burayu abattoir and its impacts on surrounding community. This design offers to the researchers a profile of described relevant aspects of the phenomena of interest from an individual, organizational, and industry-oriented perspective. Therefore, this research design enabled the researchers to gather data from a wide range of respondents on the impact of waste management practices in Burayu town. And this helped in analyzing the response obtained on how it affects the surrounding community life and health.

The study was intended to provide an appropriate framework for a study. A very significant decision in research design process was the choice to be made regarding research approach since it determines how relevant information for a study would be obtained; however, the research design process involves many interrelated decision. This study employed a mixed type of methods. The first part of the study consisted of a series of well-structured questionnaires (for sample HHs respondents) and Focus Group Discussion (practicing households, elders, women-

headed households, health extension worker, religious representative and the youth). The other design used was an interview of KII (Environmental protection, Forest and climate change Agency, City Municipality, Staff of the Abattoir and local *kebele* administration who may know more about abattoir administration set-up directly or indirectly), and field observation at the selected abattoir sites should be undertaken.

3.3 Source of Data

The research would be carried out by collecting primary and secondary data .Both methods were relevant in obtaining data for the study

3.3.1. Primary Source

Both quantitative and qualitative data type would be collected from the primary source. Quantitative date should be primarily obtained through household survey, whereas qualitative data would be obtained from FGD, KII and field observation. Interview with pre-determined questions and checklist would be among data collection tools to be used in this research

3.3.1.1. Households Survey

The surrounding communities in the study areas were the most directly influenced and/or affected by abattoir waste and collecting relevant data based on the research objective and research questions of the study has a paramount importance to embark on workable solution. Therefor to save time and resources representative sample HHs would be selected on random bases from the existing population.

A household survey was conducted using structured questionnaires designed in line with stated research objectives and research questions. As determined in sample size, in this study 330 household respondents were participated in structured interview. It was basically conducted to collect data to assess the waste management practices under taken in Burayu abattoir. In order to maintain the quality of data, scientific principles and guidelines during questionnaire designing, data collection, data filling, encoding, data entry and processing was applied. Data collectors were oriented on issues related to data collection procedures and ethics. For collecting such data the researcher employed two data collectors and trains them as to how to fill household questionnaire. Pilot study was undertaken for pre-testing the questionnaire in order to estimate the time needed to complete and implement it. The questionnaire was edited in the light of the results of the pilot study. Computer-based data cleaning was carried to check for the

completeness, consistency and accuracy of data and to identify errors that may occur during data collection or coding process.

3.3.1.2. Focus group discussions (FGDs)

The focus groups participant in the study areas were taught to be more knowledgeable and give their opinion about the positive and negative impacts on waste management practices in the study area. The member and groups would be determined based on the institutional set-up of the municipality, elder and religious representatives. Focus group discussion is important to get good ideas about the problem of abattoir activities; this was helpful to obtain additional information as supplementary to respondent's interview. Perception was personal and could be obtain through personal interview.Three focus group discussions (FGDs) were carried out with a mix of participants such as practicing households, elders, women-headed households, health extension worker, religious representative and the youth. At list 18-24 respondents were participated in three FGDs. Topics related to mention above would be addressed.

3.3.1.3 Field Observation

In addition to the above data collection methods, the personal observation was made by the investigator during the data collection processes and eye witness of the researcher in the course of data collection. Photographs were taken during field observation and might be taken various descriptive notes of what was happening. The study during the observation would be focused on abattoir waste management practices related issues with hygiene and sanitation of the area; to evaluate the overall abattoir facilities and waste management techniques and the impacts of abattoir waste on public health. In the meantime, experts and municipality administrators in the abattoir and *kebeles* would be briefly interviewed.

3.3.1.4 Key Informant Interview

The key informant interviewees were the focal persons from relevant offices including Environmental protection, Forest and climate change Authority, City Municipality, Staff of the Abattoir, health extension service, Agricultural and Livestock office and local *kebele* administration who might know more about abattoir administration set-up. Key woman in the community would also be selected purposively to appreciate the observation of the respondents about the waste management practices. Key informant interviews were "qualitative, in-depth interviews of 15 to 35 people selected for their first-hand knowledge about abattoir. The

interviews were loosely structured, relying on a list of issues to be discussed. Key informant interviews resemble a conversation among acquaintances, allowing a free flow of ideas and information. The in-depth interview would focus on organizing formal interview with the aim of facilitating open interaction between the key informant and the researcher through inviting key figures in the respective institutions relevant for the issue under discussion to participate in open dialogue forum. The KII would be done face-to-face. Key Informant Interviews involve interviewing people who had particularly informed perspectives on an aspect of the program being evaluated.

3.3.2 Secondary Source

Secondary data, on the other hand, refer to a type of data that had been previously published and could be obtained from other sources. These types of data could tell us the existing documented information relevant to the study objectives that could be raw, semi processed or processed ones such as: Witten Documents, reports and publications on the subject matter, Government policies and strategies, Legal frameworks, Concerned Sector offices and Other stakeholders (such as NGOs & other Government Organizations of the *Kebeles*, municipalities and the region.

3.4 Sampling technique

The study area (Burayu town) is one of the 19 Oromia towns in the region. According to the data obtained from the Burayu town municipality there are six *kebele* in the town. The Burayu privet limited company abattoir was selected purposively based on the availability of abattoir, its severity impact on the environment and accessibility to road and transport. The two *kebeles* also selected purposively based on their proximity to the abattoir and its severity impact on the surrounding community. For this reason, the study purposively selected Burayu plc. abattoir and three surrounding sub-*kebeles* among non-probability sampling techniques. Both had followed the same procedure, monitoring and supporting system in the sub-*kebele*. Due to this reason the study would selected purposively the abattoir, *kebeles* and sub-*kebeles*.

3.4.1 Sampling size determination

According to the information obtained from Burayu town municipality, the abattoir under study is surrounded by two *kebeles*. The two were said to be affected by the waste disposed from the firm (Burayu Admin report, 2010). These *kebeles* were the population unit for sampling. The

total numbers of households in the near two sample *kebeles* were 1,947. Then the number of sample households (the number of respondents for the household questionnaire survey) was determined to be about 330 (17% of the total households in the two *kebeles*) households with ±5% precision level and 95% confidence interval according to Israel (2013)'s established table sample for sample size determination.

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

Where:

n=is the sample size for the research use

N = is the population size (total number of households in the selected sub- *kebeles*)

e =is the level of precision (=0.05)

Sample households were selected according to the proximity to the abattoir site and included in the total sampling unit. Sample of household was be selected by random interval.

Table3. 1: Ddistribution of numbers of selected sample households for the study

No	Sample sub-*kebeles*	Number of urban households	Sample households
1	Kare Burayu	1,033	175
2	Technology	432	73
3	Burayu second	482	82
	Total	1,947	330

Source: own survey result (April and May, 2020)

As a guide, Sekaran (2003) stated that a sample size greater than 30 and less than 500 is appropriate for most questionnaires. Previously selected area determined by listing them in random order and would be taken every K th unit (every 6th, k=6).

$$\text{Sample interval} = \frac{\text{Total population size}}{\text{Desired sample size}}$$

$$K = \frac{N}{n}$$

Where

K= Sampling interval

N=total population and

n=desired sample size

3.5 Methods of data Analysis

3.5.1 Quantitative Data Analysis

Quantitative data, that was collected from questionnaire survey and secondary data sources, would be analyzed based on their data type using latest version SPSS software and excel tools in order to describing key findings, conditions, states and circumstances disclosed from the data.

This data analysis focused on numerical/quantitative data analysis. Before analysis, data coding of responses and analysis were made. In order to analyze the data obtained easily, the data were coded to SPSS 20.0 software as the data obtained from questionnaires. This task involved identifying, classifying, and assigning a numeric or character symbol to data, which was done in only one way pre-coded. Under the data analysis, exploration of data would be made with descriptive statistics which may be presented by percentage, graphical and tabular form of analysis to show the severity and depth of problem observed in the study area and major descriptive techniques would be used to summarize and compare the data.

3.5.2 Qualitative Data Analysis

Qualitative data were mostly non-numerical and usually descriptive or nominal in nature. This means the data collected were in the form of words and sentences. Often (not always), such data captures feelings, emotions, or subjective perceptions of something. Qualitative data were exploratory in nature and were mainly concerned with gaining insights and understanding on underlying reasons and motivations. Monette *et al.,* (2010), credit qualitative methods with the acknowledgement of abstraction and generalization. Polonsky and Waller (2011) categorize vision, images, forms and structures in various media, as well as spoken and printed word and recorded sound into qualitative data analysis.

The qualitative data includes key informant interview, focus group discussion, document review and observation would be gone through interpretative analysis focusing on providing meanings and explanations to the perceptions of the informants so as to dig out issues under investigation. This would be used to investigate the perception of communities on abattoir waste management practices as well as to evaluate overall abattoir facilities and waste management techniques against the applicable laws and regulation of the country. This technique would also be used to examine health impacts of abattoir waste on the community would be addressed through interpreting the qualitative means

CHAPTER FOUR: RESULTS AND DUSCUSSIONS

4.1 Demographic characteristics of the respondents

From the total of 330 sample households interviewed, about 87.6% were male headed and the rest were female headed households. As the study result indicated that male household occupied a larger size 289 (87.6%) (Table 4.1). The mean age of the household respondents were 241 (73%) 28 years. Most of the household respondents had attended secondary school 127 (38.5%). Concerning their marital status about 242 (73.3%) was married and about 31.8% of the residents had the family size of 3 per house hold (Table 4.1). Among the household respondents interviewed about 171 (51.8%) have house ownership. As the study report indicated that about 40.3% (133) of household respondents' average mean time spent at home was 12hrs/day (Table 4.1). From the interviewed household respondents about 11.5% (38) of sample households average mean duration of been living in abattoir vicinity was 4 years (Table 4.1).

Table 4. 1: Demographic characteristic of the respondent (n=330)

No	Variable	No of respondents	%	Mode
1	Sex	289	87.6	1 (Male)
2	Age	241	73.0	28 year
3	Level of Education	127	38.5	2 (secondary)
4	Marital status	242	73.3	1 (married)
5	Family size	105	31.8	3 family size
6	House owner ship	171	51.8	1 (owner)
7	Average hours spent at home	133	40.3	12 (hr/day)
8	Period of been residing in the area	38	11.5	4 year

Source: Research survey result (April and May 2020)

4.2. Community perception on the impacts of Abattoir waste

As the study result indicated that about 158 (47.9%) of household respondents surrounding the abattoir was strongly disagreed with the presence of abattoir in their vicinity. The mean of household respondents disagree with the presence of abattoir in their vicinity is 2.15 with standard deviation of 1.354 (table 4.2). As a result of poor waste management, the surrounding communities were exposed to different diseases. Accordingly, as study result shows about 48.2%, 36.4% and 42.7% of the respondents agreed as the community in the area was suffering with the prevalence of difficulty in breathing/respiratory diseases, coughing and asthma disease respectively. In other means about 3.66 (0.942), 3.75 (1.031) and 3.61(1.064) are the mean in respective with standard deviation of the local communities were suffering with prevalence of respiratory diseases, coughing and asthma disease respectively (table 4.2). As the study result

indicated respiratory diseases, coughing and asthma disease are the potential harmful disease that seriously affecting the health of the local community. As the local community responded, this prevalence of disease was the common health problems in their area associated with abattoir waste impacts.

In other case, about 38.5% and 41.2% of the respondent disagreed on prevalence of diarrhea and foot and moth diseases while, about 40% of respondents were neutrals on typhoid fever. The study result also indicated that about 37.3%, 40.9%, (30%) and (33.9%) household respondents agreed as there is high number of flies, smelly odor from abattoir, contamination of water with abattoir effluent and blockage of gutters and drainages with waste materials from abattoir respectively (Table 4.2). In average the numbers of households' concord with as there is high number of flies within the environment, smelly odor from abattoir, contamination of water with abattoir effluent and blockage of gutters and drainages with waste materials from abattoir were 3.74 (1.069), 4.32(0.755), 4.05(1.053) and 3.52 (1.084) respectively (table 4.2). From this, it has concluded that because of poor abattoir waste management, unpleasant odor and contamination of water was affecting the livelihood of the community through air and water born disease. Additionally, presence of high number of flies within the environment also affects the local community through disease transmission from one to another. Since fly is a vector disease.

The majority of residents (38.2%) agreed on improper management of the abattoir affect their children from outdoor play or activities. However, from the abattoir neighboring communities about 32.1% respondents were likely agreed to relocate from their houses as a result of poor waste management practices by the abattoir. Based on the interviewed made to the residents there were reported cases of low price of house for selling, high number of dogs and scavenger's/meat eating birds, frequent coughing and incidences of unpleasant smell among the residents. As the study result indicated the local communities, living around the abattoir found in socially and economically in crisis. These conditions were forcing the household respondents to change their house from existing (displace) to another safe area.

In general, as the study result revealed, the current condition of the abattoir waste management was exposing the community to different health problems and it becomes a health threat of the local community. Thus, it needs an immediate intervention to mitigate the abattoir waste management problem and maintain the public health of the surrounding community in particular and the town in general.

Table 4. 2: Liker't scale perception of respondents

Respondent perception	Strongly disagree		Disagree		Neutral		Agree		Strongly agree		Mean	SD
	No resp.	%	No. resp	%	No. resp	%	No. resp	%	No. resp	%		
Happy with presence of abattoir	158	47.9	61	18.5	44	13.3	39	11.8	28	8.5	2.15	1.354
Family sickness due to abattoir impacts	7	2.1	25	7.6	121	36.7	146	44.2	31	9.4	3.51	0.848
Typhoid fever	20	6.1	95	28.8	132	40.0	64	19.4	19	5.8	2.90	0.973
Coughing	11	3.3	24	7.3	88	26.7	120	36.4	120	36.4	3.75	1.031
Asthma	18	5.5	30	9.1	78	23.6	141	42.7	63	19.1	3.61	1.064
Diarrhea	45	13.6	127	38.5	119	36.1	28	8.5	11	3.3	2.49	0.946
Foot and mouth disease	58	17.6	136	41.2	101	30.6	26	7.9	9	2.7	2.37	0.953
Difficulty in breathing or respiratory diseases	13	3.9	17	5.2	90	27.3	159	48.2	50	15.2	3.66	0.942
Smell odor form abattoir	1	.3	6	1.8	34	10.3	135	40.9	154	46.7	4.32	0.755
Contaminated water with abattoir effluents	9	2.7	21	6.4	57	17.3	99	30.0	144	43.6	4.05	1.053
Contamination for air quality	9	2.7	19	5.8	76	23.0	105	31.8	121	36.7	3.94	1.036
Blockage of gutters and drainages with waste materials	15	4.5	41	12.4	96	29.1	112	33.9	66	20.0	3.52	1.084
High number of flies within the environment	12	3.6	32	9.7	75	22.7	123	37.3	88	26.7	3.74	1.069
Relocation because of abattoir activities	10	3.0	17	5.2	17	5.2	106	32.1	155	47.0	4.15	1.028
Prevent children outdoor activities/play	15	4.5	58	17.6	68	20.6	126	38.2	63	19.1	3.50	1.122

Source: Research survey result, (April and May, 2020)

4.3 Health impact of abattoir waste on surrounding community

Regarding to the health impacts of the abattoir waste on the surrounding community, the data were collected from Burayu health Bureau. Accordingly, about top ten diseases currently affecting the local communities identified and analyzed. As the study result indicated, the most important abattoir related factors identified on surrounding resident's health were contamination of air and water quality as well as unpleasant odor from the abattoir.

According to Burayu Health center annual reports indicated that there were a prevalence of disease such as typhoid fever, diarrhea, respiratory diseases, coughing, asthma and other infections has been registered by Burayu health center were associated with abattoir impacts (Table 4.3). These diseases can spread from the abattoir to the neighboring community through vectors, animals or byproducts of animal origin.

Abattoir waste just like any other waste can be detrimental to humans and the environment if definite of precautions is not taken. Some slaughter houses are littered with non-meat products and wastes that need to be recycled into useful by-products for further agricultural and other industrial uses. This constitutes public health risks and nuisance in most slaughter houses spread across markets, producing air, soil and water pollution as well as infestation of flies and other disease vectors. (Osibanjo and Adie, 2007).

For hygienic reasons abattoirs use large amount of water in processing operations; this produces large amount of waste water. The major environmental problem associated with this abattoir wastewater is the large amount of suspended solids and liquid waste as well as odor generation (Gauri, 2006). Ground water qualities in vicinity of the abattoir were adversely affected by seepage of abattoir effluent as well as water quality of receiving stream that was located away from the abattoir (Sangodyin and Agbawhe, 1992).

Air and water qualities within the residential areas are also affected by abattoir activities especially where modern or effective waste disposal system is not practiced (Bello and oyedemi, 2009) to have associated some diseases with abattoir activities which include pneumonia, diarrhea, typhoid fever, asthma, wool sorter diseases, respiratory and chest diseases (Bello and oyedemi, 2009).

According to secondary data from health centre shows most of diseases like typhoid fever, diarrhea, respiratory diseases and coughing could be the challenge of residents surrounding the vicinity of the abattoir of the study area. As the study result indicated in 2018 among the disease prevalence in the study area, tonsillitis (Acute pharyngitis unspecified) and respiratory infection

(Acute upper respiratory infection unspecified) are major disease affecting the community because of abattoir waste in their area. Similarly about 34.8% and 21.63% of household respondents were affected by tonsillitis (Acute pharyngitis unspecified) and respiratory infection (Acute upper respiratory infection unspecified) respectively. Tonsillitis (Acute pharyngitis unspecified) is major disease affecting the community because of abattoir waste in their area. Respiratory infection (Acute upper respiratory infection unspecified) is also the second major disease next to tonsillitis that affecting the community in the study area.

According to key informant and FGD revealed Burayu abattoir had poor waste management practices causes impact different types of diseases such as, typhoid fever, diarrhoea, respiratory diseases, coughing, asthma and other infectious diseases. As the study result indicated associated with abattoir wastes, about 11.03% local communities were affected with diarrhoea. In addition to these, as a study result indicated that about 31.44% and 22.22% of household were affected by Respiratory Infection (Acute upper respiratory infection unspecified) in the year of 2019 and 2020 (table 4.3). However, many different diseases associated with abattoir waste were affecting the local communities in the study area, but they are not significant as compared with Respiratory infection and tonsillitis (table 4.3). As the study results, identified through these studies as being the abattoir waste was the most problematic health waste to manage in Burayu town due to the hazardous nature of the waste type and its potential impacts on the environment and human health.

As in all survey studies, measurement of problems and differences between the abattoir neighbourhoods other than the exposure of interest could have influenced the results. However, biases are issues in any studies. It is possible that residents living in proximity to abattoir environment might report a greater number of symptoms and diseases because of negative feelings about the effect of the operation on their lives and environment. This was observed to be limited or not have been done as some diseases not related to abattoir activities were included in the questions as a check. Study was not able to evaluate the levels of impact on residents within the same area but at a distance to abattoir. Possibility of different level of effect might varies due to differences in distance, building type, direction, physical barrier, amount of time spent at home and duration of living in abattoir vicinity. Quantitative evaluation of exposure differences between individuals would increase the ability of an epidemiologic study to identify health impacts of air borne emissions

Table4. 3 : Health impact of abattoir waste on surrounding community for three years

	Health impact of abattoir waste on surrounding community(2017-2020)					
Disease	2017/18	%	2018/19	%	2019/20	%
Tonsillitis (Acute pharyngitis unspecified)	4918	34.77	1619	10.31	1377	8.71
Respiratory Infection (Acute upper respiratory infection unspecified)	3060	21.63	4935	31.44	3513	22.22
Diarrhea (Functional diarrhea)	1560	11.03	1251	7.97	1056	6.68
Typhoid fever	931	6.58	771	4.91	1638	10.36
Urinary Tract Infection (Urinary tract infection site not specified)	836	5.91	1609	10.25	1299	8.21
Infection (Other viral infections characterized by skin and mucous membrane lesions)	775	5.48	1005	6.40	777	4.91
Examination Encounter (Examination for driving license)	763	5.39	2054	13.08	1699	10.74
Infection (Bacterial intestinal infection unspecified)	681	4.81	1185	7.55	1137	7.19
Dermatitis (Unspecified contact dermatitis unspecified cause)	621	4.39	1269	8.08	1305	8.25
Dyspepsia (Inability To Swallow)	605	4.28	1359	8.66	1312	8.30
Total	14,145	100	15,698	100	15,813	100

Source: Research survey result, (April and May, 2020)

Similarly, according Burayu Health centre report, regarding the prevalence of the diseases and its trends per month for the last seven (7) months of 2019/20 was shown as table below (table 4.4). As the office report, from 2020 only 7 months data was taken concerning prevalence of disease due to covid-19 pandemic disease and also until these data was collected. According to this report, the trend of this prevalence disease was increasing over time because of poor management of wastes of abattoir, which were directly discharged to water sources nearby river of the study area (Table 4.4). These diseases are happening in all months of the year as a result of abattoir operation throughout the year. According to health extension workers (key informant) suggestion, not all, but most of the disease around the Burayu abattoir caused by abattoir wastes impacts. This means that, the surrounding community nearby to abattoir was exposed to these diseases in all months of the year. As a result, respiratory infection examination encounter

typhoid fever and tonsillitis are the major diseases affecting the nearby community to the abattoir in the study area (table 4.4). Accordingly, the number of affected community by this abattoir causality prevalence disease was increasing over time in the study area

Table 4. 4 : Diseases occurrence and trends in the past seven (7) months at the Burayu health center in the study area, 2019/20

Code	Disease	Months							
		Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Total
J00-718	Respiratory Infection (Acute upper respiratory infection unspecified)	480	547	496	266	257	247	111	2404
Z00-1944	Examination Encounter (Examination for driving license)	235	214	142	312	183	165	57	1308
A00-4	Typhoid fever	175	265	233	182	176	132	75	1238
J00-712	Tonsillitis (Acute pharyngitis unspecified)	248	189	168	111	125	107	91	1039
K20-828	Dyspepsia (Inability To Swallow)	185	200	135	101	83	159	77	940
L20-939	Dermatitis (Unspecified contact dermatitis unspecified cause)	99	157	183	95	41	120	85	780
N30-1107	Urinary Tract Infection (Urinary tract infection site not specified)	148	169	160	113	99	80	77	846
A00-13	Infection (Bacterial intestinal infection unspecified)	175	116	113	75	15	85	42	621
K55-866	Diarrhea (Functional diarrhea)	33	166	149	87	152	21	121	729
J09-720	Pneumonia (Bacterial pneumonia unspecified)	165	197	67	64	56	12	18	579

Source: Burayu Health center monthly report of 2020

4.4. Abattoir waste management practices

Abattoirs activities are one of source of waste production area which leading to environmental pollution. In slaughtering area, the wastes produced are categorized as solid waste and waste water production. Abattoir wastes could have a detrimental impact on the environment, public health, animal health and economy of the country if they are not effectively managed and controlled. Abattoirs often have difficulties in disposing, treating and processing of these wastes in an environmentally acceptable way (Adeyemi and Adeyemo, 2007).

4.4.1 Burayu abattoir plc liquid waste management

Burayu plc abattoir is largest slaughterhouse which was planted over 40 years ago, located in the heart of Burayu town between Gafarsa Burayu and keta Burayu kebeles of the Oromia city Administration surrounded by residential houses. The slaughterhouse was established having the objectives to give slaughtering service and provide clean and healthy meat for the city. As the study result indicated, Burayu plc Abattoir was slaughtered food animals on average about 300 cattle, 175 sheep and 75 goats daily at the abattoir, leading to annually produced large amount of waste (Burayu veterinary expert report, 2019)

According to the information obtained from the organization Burayu slaughterhouse uses large amount of water, estimated more than 111,460 liters/day for washing meat and cleaning processing areas. The liquid waste of abattoir consists of urine, blood and wastewater from the slaughter processes. This large amount of water consumption leads to generate a significant amount of wastewater, which is directly discharged in to Burayu River without any prior treatment. This discharge abattoir effluent whether it reaches the water body through a point source or nonpoint source reduce oxygen in water and endanger aquatic life and can leads to life threatening. The organic nutrients added to ground water produce excessive microbial growth causing unpleasant taste and odors of water from this source.

During observation waste management practices, the abattoir liquid waste such as; blood, urine, abattoir effluent/waste water, dissolved solids and gut contents were stored in septic tank for a short time until it filled. Moreover, the stored liquid waste was discharged in to the stream or river during the night and early in the morning without any treatment, which could be pollutes air, soil and water quality. Residents of downstream could be used this water for production of vegetable in small scale irrigation which might cause impact on environment and human life.

This discharge of abattoir liquid wastes has a negative impact on water quality and soil leading to environmental pollution. Besides to this, as household respondents, the discharge of this waste to the environment resulted in pollution of environment. Consequently, many thousands of local community nearby the abattoir was suffering different disease from discharge of abattoir waste to the surrounding area. According to household respondents, due to the abattoir waste there is high number of flies, smelly odor, contamination of water with abattoir effluent, blockage of gutters and drainages with waste materials from abattoir. The majority of residents reported that due to improper management of the abattoir affect their children from outdoor play or activities due to high number of dogs and scavenger's or meat eating birds and incidences of unpleasant smell in the area.

The respondents also agreed to relocate from their houses as a result of poor waste management practices by the abattoir. Consequently residents around the abattoir area facing different problems like cases of low price of house for selling and even for renting. In general, the local communities around the abattoir area were socially and economically they are found in crises. Thus, municipals of the town should intervene immediately to mitigate the discharge of abattoir liquid waste to residential area, water points and to the environment as to maintain the local community healthy and sustaining their economy.

Figure4. 1: Discharge of abattoir liquid waste to rivers (photo taken by researchers, 2020)

4.4.2 Burayu abattoir PLC solid waste management

Sources of solid waste in abattoirs include animal holding areas, slaughterhouse and processing areas, waste treatment plant, unwanted hide or skin pieces and unwanted carcasses and carcass parts. Solid waste should be kept separate from wastewater streams via the use of bucket traps and skips. This decreases the volumetric and organic load on the wastewater treatment stream (Adedipe, 2002)

The solid waste management practices, in study area abattoirs were include animal feaces (manure), legs, head bones, hooves and stomach paunch were stored for a long time in abattoir. These solid wastes include manure, intestinal contents, hairs, horns, hooves, gallbladders, trimmings, internal organs, bones, condemned carcasses or body parts, paper, carton and plastics. As the study result indicated, bone and fat soled for different industries and other like ear, tail

and hoofs were incinerated after polluting the area while stomach paunch was stored there for a long time without any purpose. Animal horns and bones were not disposed of properly are unsightly; they occupy useful space; are odorous and attract flies, and can cause nuisance.

The proclamation needs to be observed for effective EIA administration and Proclamation 513/2007 aims to promote community participation in order to prevent adverse effects and enhance benefits resulting from solid waste. It provides for preparation of solid waste management action plans by urban local governments.

The study area did not have any documents concerning law, regulations and police of abattoir and also did not have Environmental impact assessment (EIA) for abattoir but they have Environmental Management plan (EMP).Even if the abattoir had Environmental management plan they did not apply practically the plan and urban municipals and Environmental, Forest and Climate change office did not audit the abattoir.

Figure 4. 2: Solid abattoir waste to handling systems (photo taken by researchers, 2020)

4.4.3 Hygiene condition of the abattoir

Accordingly, to (GDARD, 2009) adopting good abattoir housekeeping, abattoir waste management should progressively implemented commencing with low cost, low technology practices and thereafter progressing to more sophisticated technologies. As the study result indicated, in the slaughter house area, there are storages of solid and effluent wastes. The slaughtering floor and area also covered by mud mixed with blood, which creates a suitable environment for microbial growth and subsequently leads to meat (food) contamination. Such type of abattoir could have a dangerous impact on the public health and economy of the country. The abattoir has the role and responsibility to maintain the hygiene of the slaughterhouse. Poor hygiene condition of the abattoir could have a detrimental impact on the environment, public health, animal health and economy of the country. Abattoirs often have difficulties in disposing, treating, recycling and reuse of these wastes in an environmentally acceptable way. As law, regulation and police of the country implies Proclamation 300/2002 aims to mitigate pollution as an undesirable consequence of social and economic development activities.

Figure4. 3: Solid abattoir waste handling systems (photo taken by researchers, 2020)

4.5 Waste management practices in relation to standards / regulations of the country

The presence of abattoirs, in the city of Burayu has benefited the residents in various ways. The public get meat/product of this abattoir with lower cost in its area. It has created jobs for the youth, and infrastructures for the people around the abattoirs. It also provides clean water services for the communities living around abattoir. However, the abattoir in the city has been causing environmental pollution. According to key informants and FGD there are different abattoir wastes contributing to environmental pollution in the city. These factors include; low awareness on environmental issues from public, government and owners of the abattoirs. Key informants and FGDs also explained as Burayu municipal and Buryu plc. abattoir had an agreement to reduce waste from the source of abattoir but not implemented practically. Lack of commitment to solve existing problem from the side of environmental stakeholders, discussion and dialogue with owners of abattoirs/industries on issues of environmental protection, giving appropriate attention for environmental issues by the city administration commitment from the side of abattoir owners as its focus was profit maximizing by neglecting abattoir waste management /environmental issues. The abattoir owners do not have EIA but they have EMP which was not applied practically and they were used the document as a criteria to get permission of trade license, investment and loan. The other problem was lack of strong supervision and taking corrective measures on polluting abattoir by the city's environmental authority.

Improper allocation of abattoir in residential areas of city also contributed for the problem of environmental pollution in the city. The residents have complained the saviour problems of bad odor, smoke, sound pollution, water pollution/river pollution etc. that have affected the health condition of the local community. In this regard, the researcher has got public petition on abattoir waste impact located in the Leku Keta *Kebele* which was signed in 2008 and 2010 and submitted to Burayu Environment, Forest and Climate change Authority office. In this letter, the public raised that the abattoir established in residential site by violating the city's land use plan and public health impact. This causes health impact on children and the public themselves living around this area. However, until this time there is no any solution, which was given to the public. In this regard, neither by the city's environmental authority nor the city administration was not respond to the residential complaint

Abattoirs are also the source of extremely bad odor/smell. Both the municipal and the private abattoirs are located in the resident areas causing serious damage on human health. They have a serious of quality problems and highly polluting the air as it release bad smell into the environment. In addition, both of these abattoirs realize liquid wastes into the river without any significant treatment. To solve the existing problem the environmental authority gave warning many times for improvement but the problem continued till know without significant improvement. The private abattoir is the most worst, in which different time could not bring improvement. The reason why the authority did not close it is because of the private abattoir owners tied with benefit to the government institution, this hindered the authorities' action.

The abattoirs do not use appropriate technology to reduce its impact on environment until know it relied on traditional approach which highly impacted the environment. Even if the Municipality gains more than 200, 000 birr/month from tax and other payments from these abattoir, the environmental improvement was not seen no progress made to tackle the environmental impacts of the plc abattoir in Burayu town.

The study found out that, abattoir activities have direct and indirect negative impacts on the local built environment and people health especially abattoir neighbourhood residents. The study indicated contamination of air and water quality, possible transmission of diseases as well as blockages of gutters or drainages with abattoir effluents and other waste materials due the negative impact of abattoir activities on residential neighbourhoods. There were also limited outdoor activities by the children, increased number of flies around the area and chances of relocation by some the residents to another area free of abattoir settings. The abattoir management system should include a waste management plan designed for abattoir operation. Legislative measures with regards to land use, waste disposal methods, abattoir management, odour control and provision of assessment criteria for all abattoirs should be enforced. Effort should be made towards public awareness and enlightenment on possible impact of pollution from abattoir wastes by all relevant agencies when formulating new policies for better management

4.6. The major challenges of abattoir waste management practices in Burayu town

One of the serious public environmental questions in the Burayu town is the solid waste disposal site of the abattoir. This is a very key question in relation to good governance. There is no formal landfill for solid waste disposal of the abattoir. The municipality has been dumping solid waste of the abattoir nearby the residence area without considering its impact on the people living around this area.

The city administration did not give attention to give appropriate landfills area considering serious public concern on this issue. Even when the environmental authority raises the problem, the city administration specially the municipality do not give appropriate attention to solve the existing problem. As a result, peoples which are living near this area are highly affected by this inappropriate waste dumping from abattoir. This becomes the potentials for incidence of different disease that affecting the public health.

There is poor management of solid wastes; there is no appropriate system to recycle, reuse and dispose the solid wastes for other purpose, the system of waste disposal in the abattoir is very traditional and mainly relied on dumping the solid waste into unsafe landfills. Open dump site of the abattoir is also one source of air pollution as the solid waste is burned without any selection of the waste. As a result, burning of ear, bones from abattoirs and other abattoir wastes causes high air pollution as a result of greenhouse gas emission and resulted in bad odor which affecting the health, social, economic and environmental issues of the community living nearby the area. The local communities including children are affected by asthma, scenes, influenza, common cold and other diseases.

The construction of the land fill needs high capital, high technical capacity and vast area which should be reserved for it. The area which was allocated for construction has been covered by illegal settlements and the city administration is unable to protect the area from illegal settlements. Similarly, the system of waste management in the city is very poor and awareness in the issue is also very poor. There is no practice to identify the decomposed and un decomposed waste before it is dumped into open landfill and there is no reclining activities to decrease burdens on land fill; there is no integrated solid waste management system in the city and the municipality.

The city administration decided to build landfills to solve existing problem of wastes including abattoir waste. However, in practice there is a very fragile performance from the city administration side to respond to public concern. Every year the plan is approved by the city council without any implementation. The attention given by the city administration to solve the existing problem concerning abattoir waste is very low. This is resulted from lack of awareness on environmental issues and lack of proper attention from leaders of the city administration as their main concern is economic issue rather than environmental issue that is why every year is passed by planning without implementation.

CHAPTER FIVE: CONCULUSIONS AND RECOMMENDATION

5.1 Conclusion

Burayu town is one of the towns currently structured and administrated under Oromia Special Zone Surrounding Finfinne in the Oromia National Regional State (ONRS). Burayu plc abattoir is one of the abattoirs found in center of the town which located between two kebeles namely Gafarsa Burayu and keta Burayu. This research employed descriptive research design as it would take Burayu plc abattoir waste management practices and its impacts on surrounding community.

The overriding objective of this thesis was to assess the waste management practices of Burayu abattoir and its impacts on surrounding community in study area. More specifically, the study aspired to identify the perception of communities towards the effects of Burayu abattoir wastes, assess the waste management practices undertaken in Burayu abattoir in relation to standard /laws and regulations of the country and assess health impacts of abattoir waste on the community of the study area.

Some of the FAO concepts discussed the waste management practice adoption strategies and technologies are: reuse, recycling, compost and disposal of waste. These practices have positive impacts for the production of biogas, irrigation and animal feed and consequently it resulted into environmental health.

As the study result indicated that this plc abattoir slaughters 550 of live animals per month. As a result many abattoir wastes including both solid and effluent wastes were produced every day. However, the abattoir owner has no appropriate waste management practices, do not have EIA but they have EMP which was not applied practically and they were used the document as a criteria to get permission of trade license, investment and loan. In addition to these, as the study result indicated there is lack of strong supervision and taking corrective measures on polluting abattoir by the city's environmental authority. The abattoir wastes produced in the abattoir were stored in temporary containers in slaughtering house area and these wastes were directly discharged to Burayu River during night and early morning without any treatment and consideration of its impact on the surrounding community. Regarding to the perception of local community towards the Burayu plc abattoir, as the study result indicated that about 158 (47.9%) of household respondents surrounding the abattoir was strongly disagreed with the presence of abattoir in their vicinity. As a result of poor waste management and direct discharge of the abattoir wastes directly to the rivers and downstream resident areas, about 37.3%, 40.9%, (30%)

and (33.9%) household respondents agreed as there is high number of flies, smelly odor, contamination of water with abattoir effluent, blockage of gutters and drainages with waste materials from abattoir respectively. Consequently, about 48.2%, 36.4% and 42.7% of the respondents agreed as the community in the area was suffering with the prevalence of difficulty in breathing or respiratory diseases, coughing and asthma disease. This prevalence of disease was the common problems in the study area associated with abattoir wastes and it was increasing overtime. Similarly, as Burayu health center annual reports indicated that there were a prevalence of disease such as typhoid fever, diarrhoea, respiratory diseases, coughing, asthma and other infections has been registered by Burayu health centre were associated with abattoir impacts. Additionally, as study result revealed that majority of residents (38.2%) agreed on improper management of the abattoir affect their children from outdoor play activities. As a result, about 32.1% respondents were likely agreed to relocate from their houses as a result of poor waste management practices by the abattoir and there were cases of low price of house for selling, high number of dogs and scavenger's/meat eating birds, frequent coughing and incidences of unpleasant smell among the residents.

As the study result indicate lack of awareness about environmental issues by public, government and owners of abattoir, lack of commitment to solve existing problem from the side of environmental stakeholders, low attention and commitment for environmental issues by the city administration, lack of formal landfill for solid and liquid waste disposal of the abattoir were identifying as major challenges of abattoir waste management practices. In general, as the study result revealed, the current condition of the abattoir waste management was exposing the community to different health problems, due to the hazardous nature of the abattoir waste and its potential impacts on the environment and human health. Thus it needs an immediate intervention to mitigate the abattoir waste management problem and maintain the public health of the surrounding community in particular and the town in general. Additionally, the study result indicates the abattoir need waste minimization which is to extract the maximum practical products and to generate the minimum amount of waste. These means Waste minimization was reducing waste at source of abattoir by reusing (or promoting the reuse of) materials, separating waste into different streams at source, before it is collected for recovery and recycling purposes, diverting waste from landfills through appropriate mechanisms and facilitating the processing or treatment of any recyclable waste, in an economical and environmentally sustainable manner

5.2 Recommendations

Based on the finding of this study, the following recommendations are suggested:

- ✓ Developing comprehensive management system for abattoir waste including blood wastes can be further utilized as blood meal, wastewater can be treated and reused for greenery, irrigation and cleaning purposes and intestinal contents can be used for biogas generation and the derived from it also used for natural fertilizer to reduce environmental pollution and public health issues.
- ✓ Effort should be made towards public awareness and enlightenment on possible impact of pollution from abattoir wastes by all relevant agencies when formulating new policies for better management.
- ✓ The Regional government, in collaboration with the industry, undertakes thorough study and coordinates their planning and resourcing for long-term environmentally sound disposal capacity with alternative recycling options suitable for our environment.
- ✓ The government should ensure that the future system for the disposal of abattoir waste in Burayu is strictly regulated with protocols to protect human health, economic and the environmental issues
- ✓ Building the capacity of community on negative impacts of environmental pollution on health with the goal of mobilizing all members of community to provide clean and green environment
- ✓ Long-term solutions including designing and implementing system for collecting dumps, providing urban and industrial sewage, purifying drinking water through using different methods of eliminating pollution.
- ✓ Slaughterhouse operators should be encouraged to collect the blood and sell it to local animal feed industries who would prepare blood meals for animal's production. The blood could also be used in production of pet food.
- ✓ Biogas production could also be achieved through the use of wastes such as gut contents and blood. The biogas can in turn be used to power up the slaughterhouses hence drastically reducing the operational costs.

- ✓ Treatment must be done to improve the effluent quality before discharging the waste water from the premises as to minimize environmental pollution
- ✓ Efforts should be made to commence activities towards the relocation of the abattoir to an area away from residential areas.
- ✓ Further research should be conducted to provide better understanding on the health impacts of abattoir neighboring community by combining water laboratory test, clinical evaluation of human and mental health of exposed community

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Appendixes

1: Guiding questions for all data methods

Waste Management Practices of Burayu Abattoir and its Impacts on surrounding community in Burayu town

FORM-1 (interview Questionnaires)

Instruction: Interviewers are advised to warmly welcome respondents and introduce the purpose of the study as it is purely for academic purpose. Thank them in advance for willingness to respond to the interview: Inform that it will take 25 minutes

Time started _____, Time ended _____

1. **Personal data (House head)**

1.1. Gender Male ☐ Female ☐

1.2. Level of education Primary ☐ secondary ☐ Tertiary ☐

1.3. Marital status Married ☐ Single ☐ Divorce ☐ Widow ☐

1.4. Family size ☐

1.5. House ownership Own ☐ Rented ☐

1.6. Average hours spent at home ☐

1.7. Period of been residing in the area ☐

2. Sample household interview

The impact of abattoir activities and management on residential neighborhoods according to the respondent

Does the abattoir activities has symptoms and causes diseases that may be associated with either through air borne, water borne or abattoir pollutants to you and your family

No	Variable	Respondent Response				
		Strongly disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly agree 5
1	Happy with presence of abattoir					
2	Family sickness due to abattoir impacts					
2.1	Typhoid fever					
2.2	Coughing					
2.3	Asthma					
2.4	Diarrhea					
2.5	Foot and mouth disease					
2.6	Difficulty in breathing or respiratory diseases					
3	Smell odour form abattoir					
4	Prevent children outdoor activities/play					
5	Contaminated water with abattoir effluents					
6	Contamination for air quality					
7	Blockage of gutters and drainages with waste materials					
8	High number of flies within the environment					
9	Relocation because of abattoir activities					

3. Health impacts of abattoir waste to the community

Diseases occurrence and trends in the past 6 months at the health center in the study area

Months	Name of the diseases	Patients(abattoir area)	
		No	%
November			
December			
January			
February			

Months	Name of the diseases	Patients(abattoir area)	
		No	%
March			
April			

May			

What are the common diseases listed in your health center for the last ten years?

1). _____
2). _____
3). _____
4). _____
5). _____
6). _____
7). _____
8). _____
9). _____
10). _____

4. Institutional interview

1. What are the waste management practices undertaking in the Burayu abattoir? A) Reduction B) Reuse C) Recycling D) Disposal E) all F) others if any_____

Give justification for your choice

2. How the wastes are disposed? A) Sanitary land fill B) open dump C) end-of-pump D) all

Give justification for your choice

FORM-II

Focus Group Discussion Guide

1. Focused Group Profile

1.1. Kebele _____ Gox _____

1.2. Total Number of group members' _____ (Male _____, Female_____)

1.3. Marital status (in no.): Married _____, Single _____, Divorce _____ Widow _____

2. Are you aware of the impacts of abattoir operation on public and environmental health?

3. Do you know how the abattoir manages waste generator?

4. Does the abattoir involve the community in waste management and its overall operation related to environmental sanitation?

5. What do you feel on the presence of the abattoir in your vicinity?

6. Do you know any advantage or disadvantage of abattoir on the surrounding community?

FORM-III

Key Informant Interviews

Key Informant Interview Checklist

1. How do you describe these area long years back with respect to hygiene, sanitation, climate and health?
2. What were the source of water years back (before abattoir established) and their purity, volume of water?
3. Is there common water or air born disease in this area before abattoir established?
4. How do you describe the type, composition and number (flock size of) livestock in the area, do you think that is increasing or decreasing?
5. How do you describe the type, composition and number (flock size of) wild animals in the area (before and after abattoir), do you think increasing or decreasing trend?
6. How do waste source reduction management practices influence natural environment condition in surrounding health? (Environmental experts).
7. What are the sources of water for slaughter and processing? How much litter/day water needed for treatment system? (For abattoir expert)
8. Is there any government role in waste management of Burayu plc. Abattoir? If yes state it (for abattoir expert)
9. Do they need modern abattoir? If not, what do you fear?

Observation Checklist

1). How does the abattoir waste disposal treated? Does it follow the law and regulation of the country?

2). what does the abattoir (Site) look like? Smell like? How is it set up physically? Is it in place?

3). How is regulatory bodies monitoring (auditing)?

4).What does the residential neighborhood feel about abattoir? How about abattoir location in relation to residential areas?

5). How the location is chosen? Did any environmental impact analysis (EIA) has been conducted?

6). Is there any written document about abattoir? What are they?