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**EFFECT OF LEAD BASED PAINTS INDUSTRY ON ENVIRONMENT
AND HUMAN HEALTH IN ADDIS ABABA, ETHIOPIA**

**BY
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DECLARATION

Amir Oumer, do Hereby declare that this thesis is my original work and that it has not been submitted partially or in fully by another person for an award of a degree in any other university.

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This thesis has been submitted for examination with my approval as a university supervisor.

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APPROVAL

The undersigned certify that they have read and hereby recommend to the Addis Ababa University to accept the Thesis submitted by Amir Oumer entitled “Effect of Lead Based Paints Industry on Environment and Human Health in Addis Ababa Ethiopia” in partial fulfillment of the requirements for the award of a Masters Environment and Sustainable Development.

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Table of Contents

ACKNOWLEDGEMENT	i
Table of Contents	ii
List of Tables	v
List of Figures and Picture	vi
Abstract	vii
Abbreviation	viii
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background	1
1.2 Statement of the problem.....	3
1.3 Objectives of the Study	5
1.3.1. General Objective	5
1.3.2 Specific Objectives	5
1.4 Research questions	6
1.5 Significance of the study	6
1.6 Limitation of the Thesis.....	7
1.7. Scope of the Study.....	7
1.8. Organization of the Thesis.....	7
CHAPTER TWO	8
LITERATURE REVIEW	8
Introduction.....	8
2.1. Conceptual Definition	8
2.2. Literature review	9
2.2.1. Heavy metals pollution and Effects on Human health	9
2.2.2. Human perception and attitude on Environmental Pollution	11
2.2.3. The Global Regulation of Lead in Paint	12
2.2.4. Lead in paint	13
2.2.5. Factors that affect the Effectiveness of management practices	13

2.2.6. Toxicities of lead	14
2.3. Empirical Literature review	15
2.3.1. Management of Lead in Paint Industry	15
2.3.2. Chemical Management strategy (CMS)	16
2.3.3. The Management and monitoring practice of lead release in Ethiopia	17
2.4. Conceptual framework	18
CHAPTER THREE	20
RESEARCH METHODOLOGY	20
Introduction.....	20
3.1 Description of the Study Area	20
3.1.1. Economy	22
3.1.2. Industry and Service Development Indicators.....	22
3.2. Research Design.....	23
3.3. Sampling Design and Techniques	23
3.4. Methods of Data collection	25
3.4.1. The primary data.....	25
3.4.2. Sources of secondary data	29
3.5. Methods of analysis and Interpretation	30
CHAPTER FOUR.....	34
RESULTS AND DISCUSSION.....	34
4.1 Chemical Analysis results of lead in paint in Addis Ababa Paint Manufacturing: status and variation	34
4.2. Management practices and Their Determinants of lead in paint industries	37
4.3 Perception of community on the impacts of lead in paint.....	50
4.3.1 Socio-economic and Demographic of the respondents	50
4.3.2 Response Rate.....	50
4.3.3 Knowledge of the community on lead in paint: nature of the problem, cause and effects, and legal issues	55
4.3.6 Logistic regression fitted model	59
CHAPTER FIVE	66

CONCLUSION and RECOMMENDATION.....	66
5.1. Conclusion.....	66
5.2 Recommendation.....	68
References.....	70
APPENDICES	78

List of Tables

Table 3.1. Proportional Sample Size N=296	29
Table 4.1. Lead Concentration by color of solvent-Based and Enamel Decorative paints for five different painting factories	34
Table 4.2 Response rate of the questionnaire	50
Table 4.3 socio economic and demographic characteristics of the respondent (n=296)	51
Table 4.4 Religious Affiliation of the Respondents.....	53
Table 4.5. Occupation of the Respondents	53
Table 4.6. Living Area of the Respondent.....	54
Table 4.7. Number of children per respondent	54
Table 4.8 Views of community on the Nature of problems.....	56
Table 4.9 cause and effects of lead problem related.....	58
Table 4.10 legal related results	59
Table 4.11 Goodness of fit test	59
Table 4.12 Parameter estimates of model	60

List of Figures and Picture

Figure 2.1: Conceptual Framework- Lead exposure and its impact Environment process	19
Figure 3.1. Addis Ababa City Administration Map.....	21
Figure 4.1. The status of lead (pb) content for five paint industries.....	35
Figure 4.2. Age of the Respondent	51
Figure 4.3. Educational status of the Respondent.....	52
Figure 4.4. Monthly income of the Respondent	55
Picture 4-1The rainbow paint factory treatment plant	39

Abstract

Lead (Pb) poisoning in the environment and humans an increasing global public health concern. Lead is a hazardous metal that has negative health and environmental consequences. While lead poisoning is dangerous to adults, also toxic to occupational employees and children, and the health impacts are often irreversible and can have a lifelong impact (WHO, 2015).

The purpose of the study is to investigate the Effect of lead based paints industry on environment and human health in Addis Ababa, Ethiopia. A simple structure questionnaire and KII (Key Informant Interviews and laboratory analysis of 12 samples collected from five paint factories by using atomic Absorption Spectrophotometry (AAS) that used to determine the concentration of lead in paint industry and also Logistic regression is useful for situations in which able to predict the presence or absence of a characteristic or outcome based on values of a set of predictor variables to evaluate the perception of the community/paint factory employee's was undertaken.

Results of this study indicated that, based on the laboratory analysis from different five paint factories, out of a total of 12 samples, Zhi bin Wang, Global Paint and Rainbow paint factory's analyzing 7 paints sample which is (58.3 %) the lead content was greater than 90 ppm while Nefas Silk and Kadisco paint factory analyzing 5 paint sample (41.7%) below 90 ppm or very far from standard level.. These results indicate that lead paint is commonly being sold for residential and other consumer applications in Addis Ababa without any consumer warnings.

Awareness of the community/paint factory's employee's on the impact of lead on health and environment found to be minimum.

Therefore, decision makers/ regulatory institution has to be monitored and evaluate effective implementation and corrective measures on paint firm owners in order to avert environmental pollution through awareness creation for community in Addis Ababa to ensure environment and health safeguard.

Key words: Paint, Lead, Pollution, Environment, Treatment plant, Hazardous Waste

Abbreviation

CSA	Central Statistical Agency
EPA	Environmental Protection Agency
EPCP	Environmental Pollution Control proclamation
FDRE	Federal democratic Republic of Ethiopia
GO	Governmental Organization
IPEN	International pesticide Elimination network
NGO	Non-Governmental Organization
NMA	National Metrological Agency
PAN	Pesticide Action Nexus
PPM	Parts per million
SPSS	Statically package for social sciences
UN	United Nation
WHO	World Health organization

CHAPTER ONE

INTRODUCTION

1.1 Background

Heavy metal related environmental disruption are global concern, pollution remains a major issue and presents continuing health risks. In the developing world, where common sources of pollution such as industrial emissions, poor sanitation, insufficient waste management, polluted supplies of water, and exposure to indoor air pollution from biomass fuels affect vast numbers of people, the problems are certainly greatest. However, environmental pollution persists even in developed countries, especially among the poorer sectors of society (Samet JM, et al, 2001).

A broad range of contemporary contaminants, including those associated with road traffic and the use of modern chemicals in the home, in food, for water treatment, and pest control, have also emerged in recent decades. Most of these contaminants were hardly found in extremely high amounts, health effects are typically immediate or noticeable. The identification of small effects against a backdrop of exposure variability and human sensitivity and error of measurement face significant scientific challenges (Taubes, G. and Mann, C.C., 1995).

A variety of detrimental impacts arise from the presence of heavy metals in the environment. These effects influence all areas of the climate, namely the hydrosphere, the lithosphere, the biosphere, and the atmosphere (Bánfalvi, G., 2011).

Although there is no clear description of heavy metal, it has been defined by literature as a natural element with a high atomic weight and high density that is five times greater than that of water (Bánfalvi, G., 2011). Due to their toxic nature, heavy metals have received primary attention from environmental chemists among all the contaminants (Vhahangwele and Khathutshelo, 2018).

Heavy metals in natural waters are commonly found in trace concentrations, but many of them are toxic even at very low concentrations, the limited amounts of metals such as arsenic, lead, cadmium, nickel, mercury, chromium, cobalt, zinc, and selenium are extremely toxic for human health and mammals (Herawati, N, et al, 2000).

Increasing the number of heavy metals in our resources is currently an area of greater concern, particularly as a large number of factories discharge their effluent-containing metals into freshwater without sufficient treatment (Salomons. W, et al, 1995). When they are not metabolized by the body, heavy metals become toxic and accumulate in the soft tissues. When they come into contact with humans in agriculture, processing, pharmaceutical, industrial, they may penetrate the human body through food, water, air, or absorption through the skin (Salomons. W, et al, 1995).

A typical exposure route for adults is industrial exposure. The most popular route of exposure in children is ingestion. The environment and its resources are contaminated by natural and human activities (Herawati N, et al, 2000) and (He ZL, Yang XE, Stoffela PJ, 2005).

One of those heavy metals is Lead, Lead is a poisonous metal that some paints contain. Paints contain lead when one or more lead compounds are deliberately applied by the paint manufacturer to make paint and other function. If paint ingredients associated with lead are used or there is cross-contamination from other product lines in the same plant. A paint product can often contain a certain amount of lead. Pigments are also the lead compounds most frequently applied to paint, to give the paint its color, make the paint transparent (so that it covers well), and protect the paint and the underlying surface from deterioration caused by direct sunlight, so that pigments have been used for a certain reason (WHO, 2015).

Also, lead compounds are often applied to paints used to inhibit rust or corrosion on metal surfaces. The most common Lead is tetroxide, also called Red Lead. Inorganic pigments, fillers, and probably some other ingredients used in paint production can be extracted from natural, earth-based materials and can, depending on geological characteristics, be more or less polluted with lead at the site where they were mined. This would add to the lead content of the paint as lead-contaminated materials are used in paint production (IPEN, 2015).

In most cases, a paint manufacturer can produce lead content paints far below 90 ppm that can be sold in any country in the world, by avoiding the use of lead pigments, lead driers, and other purposely added lead compounds. Many highly industrialized nations implemented laws or legislation starting in the 1970s and 1980s to regulate the lead content of decorative paints, the paints used on the interiors and exteriors of homes, schools, and other child-occupied facilities (PAN-National report, 2015).

Many developed countries also enacted regulation controls on the lead content of paints used on homes, toys, and for other applications likely to contribute to lead exposure in children. These regulatory measures have been taken based on scientific and medical findings that lead paint is a major source of childhood lead exposure and that childhood lead exposure causes serious harm, particularly to children at the aged six and under (PAN- National report, 2017).

Ethiopia is one of the least urbanized nations, with approximately 80.6% of the population living in rural areas, which is one of the countries where urbanization is large. Currently, Ethiopia's urban population is around 17.4 million. Studies show that by 2030, the number will rise to 30 million, with an annual growth rate of 5 %. This showed that, as the population grows, the extraction of natural resources, solid waste production, industrialization, and energy use will increase, as a result of this, and the entire ecosystem will be obliged to serve beyond its carrying capacity (UN-Habitat National Urban Profile 2004/2005; PASDEP 2006).

Addis Ababa painting manufacturing companies are considered the fastest-growing industrial belt in Ethiopia. Most of the industry used lead-based pigments are often used in addition to other pigments, and often used alone. In enamel (oil-based) paints for use as driers, lead compounds can be added to (sometimes called drying agents or catalysts). Through a process that involves chemical reactions in which paint ingredients called binders polymerize and crosslink, enamel paints dry to a hard and smooth surface (IPEN, 2017).

1.2 Statement of the problem

Lead is a toxic metal whose pervasive use has caused extensive environmental pollution and health problems in several regions of the world. Whereas lead exposure is also harmful to adults, harms children at much lower levels, and the health effects are generally irreversible and can have a lifelong impact. The younger the infant, the more variable dangerous lead can be, and at an elevated pace, children with nutritional deficiencies consume ingested lead (Weinberg, J. and Clark, 2020). The developing embryo is the most fragile, and lead that has accumulated in her body can be passed to her growing child by a pregnant woman. Lead is also transmitted when a lead is present in a nursing mother by breast milk (National report lead enamel household paint in India, 2015).

In particular, large concentrations of lead are likely to be found in or adjacent to lead smelters, lead mines, houses painted with lead paint, arsenate-treated orchards, and urban areas where heavy car traffic has occurred. Lead sources of dust and soil also include lead that falls from the air to the ground, and lead-based paint withering and chipping from buildings and other structures (Seema,T. et al, 2013).

These facts showed that if there is a rise in populations, manufacturing activities and the usage of lead added goods and inappropriate waste management, including waste incineration and an increase in the number of vehicles using leaded and using lead in paint factory at high concentration with lack of restricted management practices, the city has received numerous toxic chemicals, including Lead for the current and potential urban environment (Seema,T. et al, 2013).

In all aspects of our climate, the air, the soil, the water, and even inside our houses, lead can be found. Most of our contamination comes from human activities, including the use of fossil fuels, including previous use of leaded gasoline, some types of manufacturing plants, and previous use in homes of lead-based paint. In a wide range of items used in and around our houses, lead and lead compounds have been used, including paint, ceramics, pipes and plumbing materials, Welders, fuel, and ammunition (Seema,T. et al, 2013).

Because of lack of weak enforcement of regulatory institution, most painting industrial goods use lead paints as input, store, manufacture, export, distribution, selling, and use of paints containing lead above 90 ppm concentrations. And the city had bad waste management practices and the minimal Management Process also contributes a great deal of lead release to water, land, and air. The quality of air, water, and soil is therefore steadily degraded by the leads emitted from those sources.

Studies have shown that non-communicable diseases such as cancer, kidney malfunctions, blood poisoning, and reproductive failure, and other problems have arisen from time to time. These issues are more or less linked to the contamination of the atmosphere in the absence of a chemical management system at the national and regional level (WHO, 2015).

Increasing human activities such as industrialization coupled with over-population amongst other factors have become major environmental issues because they increase the demand for construction and real estate which in turn broadens the application of lead in the painting industry. There are many different paint industries in Addis Ababa. On the other hand, there is a lack of management and monitoring mechanism on ways of disposal site of the by-products of lead chemicals.

Because of lack of awareness is offered to the workers nor effective management system for lead in the painting industry the public can exposed acritical environmental and health problem which coming from the release of lead-by product or other hazardous chemicals.

There is an official regulation document on the restriction of using lead in painting are prohibited to use more than 90 ppm (0.009%) but most of the painting industry is not respect the regulation standard even in recent days. Besides this most of the paint industry is not labeled their product whether lead contents are applied or not in a specific brand. Due to those major gap our environment and human health are affected by the exposure of lead in paint industry in Addis Ababa painting manufacturing companies.

1.3 Objectives of the Study

1.3.1. General Objective

Assessment of Statues and variation Lead Concentration of paint industry in Addis Ababa, Ethiopia.

1.3.2 Specific Objectives

- To investigate lead concentration in sampled paint industries in Addis Ababa.
- To assess the current management practices and their determinants of lead in paint industries.
- To assess the perception of the community on effect of lead.

1.4 Research questions

To achieve the intended general and specific objectives, it is important to raise the following basic question.

- How does the quantities of lead amount for each painting industry vary?
- Is there current management practice of lead in the industry effective to avert the problem?
- What is the public perception of the impacts of lead?

1.5 Significance of the study

Many significant changes are taking place in the capital city of Ethiopia presently. For example, as an indicator of these changes, the economic growth due to the establishment and expansion of industrial activities and the relocation of immigrants from the distance between a rural and urban region can be used as an indicator. These changes can also contribute to the quality of the urban environment as well as human health being driven down. Enhancing the efficiency of the framework of environmental governance is, therefore, necessary, unless issues are increasingly causing threats to the current and future environment and human well-being. The reduction of the deliberate use and the release of lead from the paint industry, where applicable, therefore, the essential part of the environmental management practice will be applied, the human and environmental health will be safe. Hence, the finding of the study can contribute to creating awareness for the paint user, Employee and provide the management practices among the paint industry and provide additional information and understanding to local conditions through providing some awareness related to the impact of lead.

- To know the maximum use of lead paint in the industry of the Addis Ababa City,
- To review the regulation instrument on the management of lead,
- To encouraging other interested individuals to carry out further research in the area,
- To provide best Waste treatment technology and to integrate developmental activities by considering the management of lead release.

Finally, this study will be used as input for a policymaker to make strong legislation for regulation, researchers will use as a source and the amount of lead in paint in this study area was quantified.

1.6 Limitation of the Thesis

Several limitations was observed during this study, namely the availability of activity data within the organization, shortage of actual information from the paint factory, lack of willingness to get paint samples to quantify the release of lead to assess the management practices and lack of respondent Knowhow about the issue of lead in painting management which were be limitation encountered during the study.

1.7. Scope of the Study

The study were focus on the five painting industries such as Nifas silk paint factory, kadisco paint, and Adhesive P.L.C., Zhi bin Wang Paint Industry, Rainbow Paints Industries and Sons industry P.LC (global paint industry) which is located in the capital city of Ethiopia, with special references to examining the amount of lead in paint, management practices of lead panting from different painting industry and assigning public perception about the impact of lead in paint in Addis Ababa.

1.8. Organization of the Thesis

The study is organized in to five chapters. The first chapter is devoted to the general introduction of the study. This chapter comprises and discuss about the background, problem statement, objectives, research questions, significance, scope, and organization of the study. The second chapter discuss about literature review of the study. It consists of theoretical and empirical literatures and conceptual framework related to the study. The review of related literature and conceptual framework explore the conceptual classification of literature and theories that are related with this study area. The third chapters devoted to the methodology of the thesis. In this chapter, the research design, data types and sources, sampling techniques, data collection methods, and method of data analysis are discussed. Chapter four is about dissection of the results and findings of the study. Finally, chapter five is left for conclusion of major findings and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

Introduction

Reviewing the available literature on the topics where conducted to check whether the problem was addressed by the previous researchers or not; acquire insights on how previous addressed similar issues; identify the research gap and refine the research problem. Thus the topic is divided into two parts. Part one deals with the theoretical literature review and part two discuss the empirical literature review. Under the theoretical review, lead and human health impacts, Lead release, and management practice, Toxicity of lead inland, and water where disused. The empirical literature review includes the discussion of experience and practices in different countries.

2.1. Conceptual Definition

Heavy Metal; Any metallic chemical element with a relatively high density that is toxic or poisonous at low concentrations is referred to as heavy metal. Mercury (Hg), Cadmium (Cd), Arsenic (As), Chromium (Cr), Thallium (Tl), and Lead (Pb) are examples of heavy metals (Appenroth, K.J., 2010).

Lead; Lead is a naturally occurring bluish-gray metal that is present in the earth's crust in limited quantities and lead can be found in all areas of our world (Lead in paint control council of ministers regulation No. 429/2018).

Bioaccumulation; is the process by which organisms (including humans) take up contaminants more rapidly than their bodies can eliminate them, thus the amount of lead in their body accumulates over time (Lead in paint control council of ministers regulation No. 429/2018).

Lead in paint; means paint to which one or more compounds typically added to paint and includes lead carbonate, lead chromate, lead chromate oxide, lead chromate molybdate sulphureted, lead sulphurochromate yellow, lead 2-ethylhexoate, lead sulfate, trilead-bicarbonate dihydroxide. Lead is applied to paint to speed up drying, improve longevity, retain a fresh perspective, and avoid corrosion-causing moisture (Lead in paint control council of ministers regulation No. 429/2018).

Total lead concentration; means the percentage by weight of the total non-volatile element of the dried paint film substance (Lead in paint control council of ministers regulation No. 429/2018).

Product that has lead in paint as input; includes child's toys, indoor and outdoor playground equipment, children's books, art materials, home furnishing materials, and other products that used lead in paint as an input (Lead in paint control council of ministers regulation No. 429/2018).

Public perception; is defined as the public understanding and opinion about a specific issue.

Toxicity; The degree to which a chemical element or a mixture of chemicals can harm an organism (Merriam-webster.com. (2019).

Chemical management; is a method of procuring, handling, using, and disposing of chemicals in a plant in a systematic manner (HR Health & Safety policy Chemical management policy,2005).

2.2. Literature review

2.2.1. Heavy metals pollution and Effects on Human health

The term "heavy metals" refers to metallic elements with atomic weights more than 40.04. By natural and anthropogenic means, heavy metals are entering in to the climate. These causes include natural weathering of the crust of the earth, mining, soil degradation, industrial discharge, urban runoff, wastewater, plant pest or disease control agents, the fallout of air pollution, and several others (Morais, 2012).

Although some people are mainly exposed in the workplace to these pollutants, the primary route of exposure to these toxic elements for most people is through diet (food and water). The heavy metal pollution chain almost always follows a cyclical order: manufacturing, environment, soil, water, food, and humans (Matta, 2015).

Even though toxicity and the subsequent threat to human health well-known that chronic contact with heavy metals and Metalloids can cause adverse effects at relatively low levels (Castro and Mendez, 2008). While focusing on developing countries the conditions are getting more

catastrophic due to an increase in industrial complexes with a minimal follow-up of environmental and pollution control guidelines (Matta, 2015 and Arora, 2014).

Lead poisoning is a global public health concern with the World Health Organization estimating that it contributes 0.6% of the global health burden coming from lead exposure. Children are at the most risk of lead poisoning and the health effects of poisoning are more severe in children who are still developing. The typical sources of lead exposure to children include soil, air, water, toys, cosmetics, batteries, putty, cement, canned foods, jewelry, and paints, especially from houses painted are the main source. Children under the age of six years are particularly at risk because of their frequent hand-to-mouth and object-to-mouth behaviors which expose them to toxicity by ingestion (Mutono, A., et al, 2019).

Lead is known to be one of the most harmful and accumulated environmental contaminants affected by exposure to air, water, and food sources in all biological systems (Patra, R.C, Rautray, et al 2011). Clinical pathological changes due to toxicity arising in the renal and endocrine systems are caused by lead exposure (Jadhav, S.H., Sarkar, et al, 2007). Reproductive failure has resulted from a high level of lead in animals (Ahmed, W.M., Abdel-Hameed, et al 2008).

Lead is one of the world's environmental toxins, primarily found in industrial areas, so it is easy for humans and animals to be exposed to lead. Lead poisoning can be found from various sources in the general environment, especially in livestock, and this can be traced back to contamination of feed and soil from industrial waste and farming practices. In addition, high lead intake has to poisoning, and death in humans and animals (McDowell, L.R., 2003) and (Burki, T.K., 2012).

In any of its chemical types, accumulated lead is harmful, be it inhaled or ingested in water or feed. The degree of absorption of orally administered lead into the host is limited. However, harmful concentrations of lead will accumulate in tissues after prolonged exposure to low concentrations due to its slow rate of removal (Ercal, N., Gurer-Orhan, et al, 2001).

Lead is a heavy metal that is an environmental toxicant that is both poisonous and pervasive. It is distributed in three major types in all areas of the environment: metallic lead, lead salts, and carbon-containing organic lead (Ahamed, M. and Siddiqui, et al, 2007).

Traditionally, lead oil, lead-based paints, and batteries are the main sources of occupational lead exposure. Over recent decades, lead exposure has been widely recognized as a major public health concern, and high levels of occupational lead contact are now strictly regulated because of their adverse health effects. Nevertheless, exposure to environmental lead, such as domestic drinking water, food-borne pollution, and household dust, tends to pollute our atmosphere in everyday life. Lead exposure is known to be toxic and associated with human behavioral disturbances, hearing deficits, neuromuscular distortion (Spivey, A, 2007).

Lead poisoning in young children in urban slums is a major cause of brain damage, mental deficit, and serious behavioral issues. It is difficult to diagnose, is frequently unrecognized, and was widely overlooked by doctors and public health officials until recently. Public attention is now finally focusing on childhood lead poisoning, although it has just begun the challenging task of eradicating the exposure of lead. The consequence of extremely high levels of lead in the tissues is symptomatic lead poisoning (Matta Gagan, Kumar Ravindra, et al, 2015).

Lead is one of the most ubiquitous natural substances concentrated in the immediate environment. It is reported that environmental pollution is a wide-reaching problem and it is likely to influence the health of human populations is great. It was also found that the insight view about effects of environmental pollution in the perspective of air pollution, water and land/soil waste pollution on human by diseases and problems, animals and trees/plants (Matta Gagan, Kumar Ravindra, et al, 2015).

2.2.2. Human perception and attitude on Environmental Pollution

Information on pollution has not only been provided to the public by environmental education and media coverage on pollution harm and health risks. Because of public concern about the necessity and efficiency of environmental regulations, these divergences are likely to impact their implementation. Official monitoring data based on objective indicators (e.g. pollutant concentrations) reflect actual environmental conditions; however, these datasets are not widely recognized by individuals or the public (Liu, Anderson, and Cruz, 2012).

Accurate perceptions of the environment help recognize and support government decisions and are crucial for pollution and health hazards to be recognized. Effective and positive public responses to environmental pollution issues are critical to minimize these dangers. Although the

public is not necessarily expected to alleviate pollution themselves, perceptions and appropriate responses to pollution, which can be summarized as the basis of environmental awareness; can help to protect the public from toxic environments, to follow environmentally sustainable lifestyles, and to dedicate themselves to improving the quality of the environment (Liu, Anderson, and Cruz, 2012).

However, the accuracy of current public perceptions and responses to pollution conditions, as well as the possible health hazards connected with pollution, receives little consideration. It is necessary to evaluate these indicators to determine whether current environmental publicity and education are effective in improving public environmental awareness. Meanwhile, the results of such an evaluation could help identify and address the deficiencies in environmental policies and social development (Chen, Y., et al, 2017).

2.2.3. The Global Regulation of Lead in Paint

In the 1970s and 1980s, most highly industrialized countries enacted legislation or regulations to limit the amount of lead in decorative paints. Most also set limits on the amount of lead in paints used on toys and other products that could expose children to the poison (Weinberg and Clark, 2012).

Countries have adopted a variety of legislative policies, many of which relate to the lead paint ban. In the European Union, the use of lead in the manufacture of paint is restricted by provisions for particular leaded paint ingredients, as well as laws governing worker health and consumer product protection (Weinberg and Clark, 2012).

Many countries have enacted laws limiting the amount of total lead used in households and other paints. In countries including Canada, China, Colombia, Ethiopia, Israel, Kenya, the Philippines, and the United States, the most protective regulatory limits on lead in household paints have been set a total lead content more than 90 parts per million (ppm) (dry weight). Several other countries are now considering adopting this legally binding limit, which guarantees that a paint manufacturer can sell its product worldwide (Weinberg and Clark, 2012).

2.2.4. Lead in paint

Lead paint is usually created also for some reason the paint manufacturer purposely adds one or more leaded compounds to the paint. However, a paint product may also contain some amount of lead when paint ingredients contaminated with lead are used, or when there is cross-contamination from other product lines in the same factory. Leaded paint ingredients are most commonly used intentionally in solvent-based paint due to their chemical properties, and solvent-based lead paint has been found in many countries (Brosche, s., et al, 2014).

Pigments are the lead compounds most widely applied to solvent-based paints. Pigments are used to give the paint its appearance, make the paint opaque (so it covers well), and protect the paint from deterioration caused by the paint and the underlying surface exposure to sunlight. Lead-based pigments are often used in association with other pigments and often used alone. Leaded compounds for use as driers can also be applied to enamel paints (sometimes called drying agents or drying catalysts). Leaded compounds are also sometimes added to paints used to inhibit rust or corrosion on metal surfaces (Rathnamalala, E., et al, 2015).

2.2.5. Factors that affect the Effectiveness of management practices

In many countries, public awareness-raising efforts are a key component of any national lead paint elimination strategy. However, this does not need to be the case in all nations. Relevant government officials and/or political leaders in a country might see the need to take action to protect their public health and the environment from lead in paint before the public demanding it. In such cases, an effective lead paint control law or regulation might be adopted and enforced without much of the public even being aware that lead paint ever was a national issue or concern, In most countries some public awareness-raising efforts will be needed (Chen, Y.et al, 2017).

The government officials in health and environment ministries who best understand why it is important to eliminate lead from paint often do not have the high-level political or institutional support that they need to adopt and enforce an effective, legally binding national lead control instrument. And in many countries, political leaders and higher-level officials may be more willing to support the adoption of a national lead paint control instrument if they perceive that sectors of the public and key stakeholder groups in society are concerned about the issue and are

expecting the government to act. Awareness-raising efforts may additionally serve to convince consumers to avoid the purchase of lead paints and may convince paint manufacturers and vendors that continuing to produce and sell lead paints may be harmful to brand reputation and decrease brand equity (Jack Weinberg and Scott Clark, 2012).

Fortunately, public awareness-raising on issues relating to lead exposure and lead paint is relatively low. In most countries, many people are already broadly aware that lead exposure is bad, especially when children are exposed. Additionally, the evidence of harm from lead exposure is so strong and well-documented that industry representatives have generally been unwilling to try to publicly argue the case that there is no good reason for the public to be concerned about lead house paints and other lead paints for children related applications. It appears that lead decorative paints can only prosper in the marketplace when the public is kept unaware of them. Lead decorative paints become an embarrassment to their manufacturers, suppliers, and brand owners once the public learns about them. Experience so far has shown that lead paint is an issue that often easily attracts the interest of the press: both print and electronic media. There is currently no data available in most countries on the lead content of decorative paints for sale on the national market. When new data is generated by sampling and testing, and when the results show that some or many of the paint brands on sale contain hazardous quantities of lead, the press is often willing to prominently report on the story. When doing so, it is generally also willing to report on the harms associated with lead exposure in children, on the contribution of lead paint to childhood lead exposure, and so on. Finally, after the national news media has already once widely reported on the issue of lead paints, it is often relatively open to possible follow-up stories (Jack Weinberg and Scott Clark, 2012).

2.2.6. Toxicities of lead

Lead poisoning tends to be very common in heavy metal poisonings. Since ancient times, the use of lead has been demonstrated and its toxicity reports are well known. It has been used all over the world because of its major physico-chemical properties. With the beginning of industrialization from the seventeenth century onwards, its use expanded in several forms, leading to increased human toxicity. Children are at a higher risk, particularly at sites where their playing grounds are close to lead-related occupations. There is also an elevated risk of lead poisoning for employees who are occupationally exposed to lead. To prevent lead-related

hazards, children of parents who are occupationally exposed to lead should be regularly tested for lead levels in their blood (Flora, et al, 2012).

From the literature, lead toxicity is apparent and there is almost no role in the body that is not influenced by lead. Lead toxicity disrupts the functions of the digestive system, nervous system, respiratory system, reproductive system, and so on. Furthermore, lead prevents enzymes from carrying out their normal activities. Lead also disrupts the natural process of transcription of DNA and causes bone impairment. Lead, as such, has no physiological function in the body and toxicity can be caused by even smaller amounts of lead (Ara, A. and Usmani, J.A., 2015).

2.3. Empirical Literature review

Under this section, empirical literature reviews on management practices of Lead in paint release in a developed and developing country are presented.

2.3.1. Management of Lead in Paint Industry

The 59 largest paint manufacturing companies in the world stop producing and selling lead decorative paints in all markets by 2015, at the latest. These companies produce most of the decorative paints on sale in the world. It is reasonable to demand and expect that these top companies completely halt the manufacture and sales of all lead decorative paints, including by all of their subsidiaries, by 2015 (Weinberg and Clark, 2012).

All of these companies have the knowledge and technical skills needed to eliminate the use of lead compounds in the formulation of all their decorative paints while still offering consumer high-quality, cost-competitive products. In addition to decorative paints, priority attention also should be given to the elimination of other categories of paints most likely to contribute to childhood lead exposure. These include paints used as coatings in the manufacture of toys, pencils, cribs and playpens, furniture, and other household items, especially ones that children may chew on. They also include rust and corrosion-resistant paints for use on metal surfaces that are sold for home use or use on school playground equipment and similar applications (Weinberg and Clark, 2012).

Legal management system

Eleven countries (33%) in the Latin America and Caribbean Region have lead paint laws. Most countries in this region have chosen to set a 600 ppm total lead concentration limit, having passed regulations considerably earlier than much of the rest of the world, which was the US standard prior to 2009. Argentina, Brazil, and Mexico are attempting to update existing legislation and standards to cut the lead in paint limit from 600 to 90 parts per million (Jack Weinberg and Scott Clark 2012).

The manufacture, sale, distribution, and import of surface coating products for use on buildings and schools that contain total lead content greater than or equal to 600 ppm (0.06 percent) of the non-volatile portion of the dried paint as determined by laboratory testing in accordance with national or international technical standards is prohibited under Brazilian law. Paint companies and vendors were given one year to comply and remove lead paints from their supply chains. It was illegal to sell lead paints once the regulation came into force in August 2009, even if stocks remained (Jack Weinberg and Scott Clark 2012).

In September 2011, the Sri Lankan national Consumer Affairs Authority, using powers granted to it by the Consumer Affairs Authority Act, published a lead paint control directive which states: No manufacturer, importer, packer, supplier or distributor shall produce, import and use or export, pack, store or sell or display any painting for sale, an exhibit for sale or offer for sale, wholesale or retail unless such paints comply with the corresponding total lead content specified by the Sri Lanka Standard Institution for such paints (Jack Weinberg and Scott Clark 2012).

2.3.2. Chemical Management strategy (CMS)

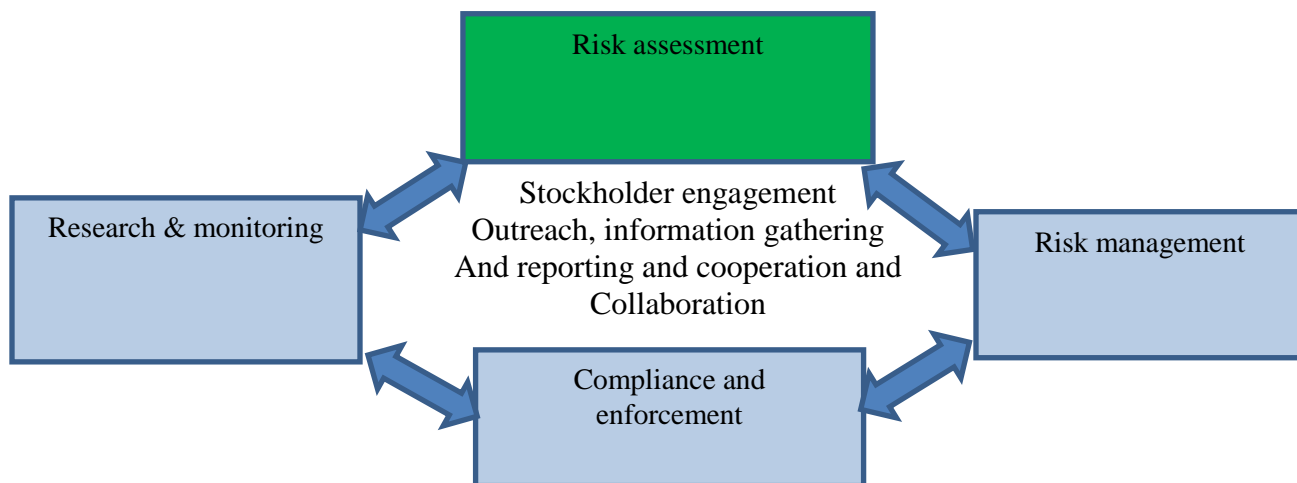
Assesses environmental and human health risks posed by chemical substances, and develops and implements measures to prevent or manage those risks. by using the most appropriate management tools from a broad suite of laws, including the Environmental Protection Act and other.

The entire life cycle of chemicals required to accomplish the work must also be considered. These issues include, but are not limited to, engineering controls, chemical disposal, emergency response, medical monitoring, personnel training and exposure, facility and equipment contamination, and release to the environment.

An effective chemical management program has a number of definable elements. First and foremost, the program is part of the site's overall environmental management. However, there are some elements that, while not unique to chemical management, should be addressed in terms of the hazards posed by chemical usage (Pedro, 2015).

The Chemicals Management Strategy protects human health and the environment by assessing chemicals used in Belize and by taking action on chemicals found to be harmful. This CMS is a highly integrated program that addresses environmental and health risks under various requirements.

Furthermore, prior to the introduction of substances new to Belize, the Government assesses and, when necessary, manages any potential risks to Belizeans and their environment.



2.3.3. The Management and monitoring practice of lead release in Ethiopia

Occupational lead exposure is entirely unregulated in many developing countries, often with no exposure monitoring. In Ethiopia, while there are numerous small-scale and large industries that use lead-based raw materials that may pose health risks to employees, there are no lead exposure regulations in the workplace and no data are available among employees of small-scale lead-based units with respect to lead poisoning with the labor departments. Many individuals employed for various manufacturing or service renderings organizations, such as the painting industry, battery manufacturing staff, gas station assistants, radiator repair personnel, and welders, are engaged in jobs that expose them to incremental health risks from lead

contamination without having any knowledge of the materials they treat. Workers typically eat, smoke, or drink while at work due to a lack of knowledge of their exposure and such workplace practices can aggravate their exposure (Adela et al, 2012).

2.4. Conceptual framework

Lead exposure particularly vulnerable group in our society. This study was contribute to existing knowledge by assessing the management practice of lead and analyzing the prevalence and environmental health effects of lead exposure in Addis Ababa. Good environment and health is a global goal; however, there are environmental and social factors that put the health of the individual, the community, and ultimately societies/populations at risk.

The conceptual framework illustrated in Figure 2.1 is based on the weak compliance and monitoring practice lead in the painting industry that used excess usage of lead above the regulation standard that describes the main factors and exposures and their relationships that contribute to environmental pollution in a particular area. Exposures of lead to environmental health effects and can be mitigated or enhanced by social, economic, and environmental factors.

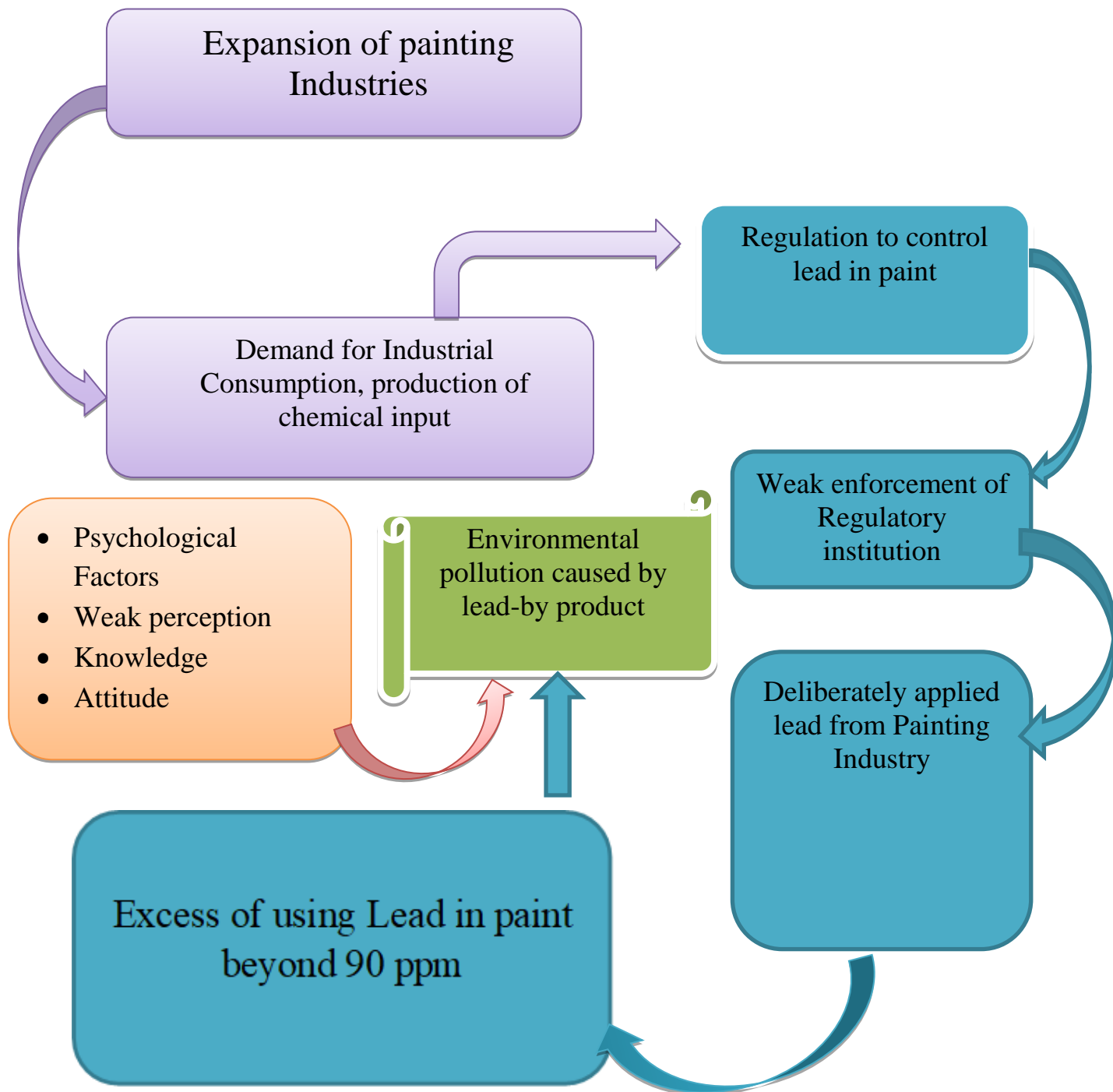


Figure 2.1: Conceptual Framework- Lead exposure and its impact Environment process

CHAPTER THREE

RESEARCH METHODOLOGY

Introduction

Accordingly, this chapter presents the research design upon which the entire study was built. It presents the research design, sampling design and techniques, method of data collection and ways of analyzing, interpreting, and presenting data was included on this chapter.

3.1 Description of the Study Area

Addis Ababa, Ethiopia's political capital as well as the country's most important commercial and cultural center. It is 2,400 meters above sea level on average, with the maximum altitudes reaching 3,200 meters on Entoto Hill to the north. Addis Ababa is therefore one of the world's high-altitude cities.

Addis Ababa covers a total size of 540 square kilometers and is surrounded by mountainous landscape. Despite the there is no main river flowing through or near Addis Ababa, the city's tiny rivers and streams played a significant role in shaping its form.

Addis Ababa has a sub-tropical highland climate with a year-round average temperature of around 23°C for the high and 11°C for the low. Kiremt, the primary rainy season, lasts from June to early October, while Belg, a short season of rain, lasts from early March to mid-April. The average annual rainfall is around 1,200 mm, with over 80% of that falling during the rainy season (NMA 2017).

The city is divided into 11 kifle-ketemas, or sub-cities, and 121 woredas, or administrative divisions.

Addis Ababa is one of Africa's fastest-growing cities and Ethiopia's capital, with a population of over four million people, or about a quarter of the country's total urban population and more than ten times the population of Adama, the country's one of the largest city (MoUDHC 2015).

The last census in Ethiopia was carried out in 2007, thus current population of the city is based on estimates. There are many estimates some of which put the population close to 5 million. However, the national central statistical agency that carries out national census projections put

the population of Addis Ababa to be 3,774, 000 by 2021 (CSA, 2015).

The city serves as the hub for many national and international offices such as the African Union. Most of the people lead their life as being civil servants, merchants, and daily laborers. Several people come to the city for search work and services due to its location and status. Its yearly growth rate is between two and four percent, with rural-urban mobility accounting for around forty percent of that. At birth, the average life expectancy is 65.7 years, and the infant mortality rate is 50.3 per 1000 live births (CSA 2013).

Addis Ababa's social and physical infrastructure has improved in quantity over the last few decades, but it still needs to be improved significantly in terms of quality and distribution. The government's urban investment initiatives, which combine the development of the urban environment with the provision of economic possibilities, particularly for urban youth, have produced some promising outcomes. However, policies and methods must be assessed, adjusted, or replaced in light of their contribution to addressing the city's chronic challenges (Erena D. et.al, 2017).

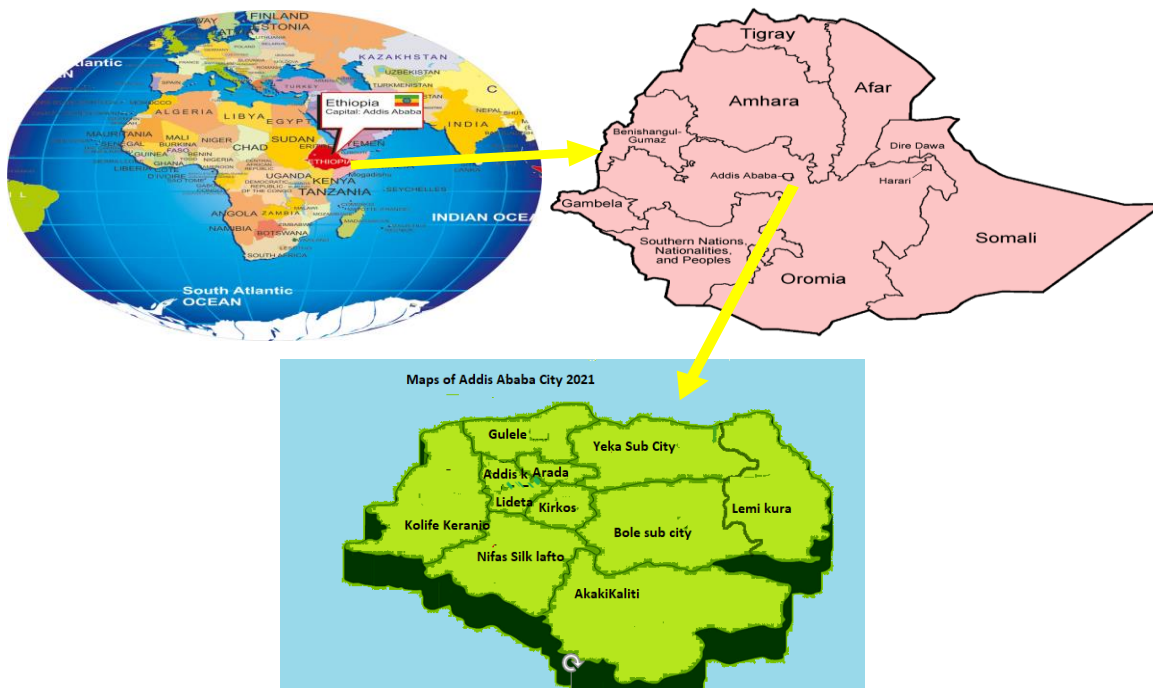


Figure 3.1. Addis Ababa City Administration Map

Source: <http://www.mapsnworld.com/ethiopia> and Arc GIS

Climate

The city has a dynamic combination of highland climate zones, depending on elevation and prevailing wind patterns, with temperature variations of up to 10 °C (18 °F). The high altitude moderates year-round temperatures and the location of the city near the equator means that temperatures are very stable from month to month (NMA, 2017).

3.1.1. Economy

Through Addis Ababa, the economic activities are varied. According to Addis Ababa bureau of finance and economic development reported that from the federal government, 119,197 inhabitants of the city are engaged in trade and commerce; 113,977 in manufacturing and industry; 80,391 homemakers of different varieties; In civil administration, 71,186; in transport and communication, 50,538; in education, health and social services, 42,514; in hotel and catering, 32,685; and in agriculture, 16,602. The city has been in a construction boom recently, with high rises growing in many areas. Its geographic location is in the middle of Ethiopia, which has provided the capital majority of the country's social and economic infrastructure, combined with a lack of development policies in other urban centers. As a result, hundreds of thousands of people, coming from all corners of the world in search of better jobs and services, have become a melting pot. Around 40 percent of the growth accounts for this high rate of rural-urban migration. Addis Ababa, one of the fast-growing cities in Africa, contributed to the rapid natural population growth, presents crucial challenges, including a high rate of unemployment, housing shortages, and environmental degradation (AABoFED,2015).

3.1.2. Industry and Service Development Indicators

According to Finance and Economy Bureau, August 2002, In Addis Ababa, the industries and service sector has grown rapidly from year to year rather than the agriculture sector. Thus, different figures indicated that the service sector is the leading from both the industry's and agriculture sector. Those sector has created job opportunities for urban inhabitants also contributes to the city revenue.

3.2. Research Design

It was adopted both quantitative and qualitative methods. Quantitative research is characterized as a structured, objective, systematic process in which relationships are identified and tested and cause and effect interactions between variables are examined (Burns and Grove, 1993). For descriptive, explanatory, and exploratory analysis, surveys were used. It was possible to use a descriptive survey design. To define a population too large to directly observe, a survey is used to collect original data (Mouton, 1996). By way of self-report, a survey obtains information from a group of people, that is, the people respond to a set of questions asked by the investigator (Polit & Hungler, 1993).

In this study, the information was collected through self-administered questionnaires distributed personally to the subjects by the researcher. A descriptive survey was selected because it provides an accurate portrayal or account of the characteristics, for example, behavior, opinions, abilities, beliefs, and knowledge of a particular individual, situation, or group. This design was chosen to meet the objectives of the study, namely to determine the knowledge, and awareness of the public and also management practice of lead in paint in a selected industry (Mouton, J, 1996).

3.3. Sampling Design and Techniques

Surveys or questionnaires were useful for gathering information on the profile of job responsibilities. Both quantitative and qualitative information were used for surveys. Surveys were collected through face-to-face. The face-to-face surveys may be conducted in combination with observational techniques such as by visiting the painting industry's or by interviewing paint employees.

The five paint factories and 12 sampled paint workers were selected purposefully. Among the five paint factory employees, the number of sample size determined for this study was selected using simple random sampling technique from each paint factory included in this study. Simple random sampling technique was preferred and used to select paint employees' respondents, because this sampling technique gives equal chance for each member of the population the likelihood of probability of being chosen for the study as a sample.

Thus, using name list of employee from work attendance sheet, the sample respondents were selected randomly until the required number of sample is obtained from each paint

factory included in this study.

To determine the number of sample respondents for this study, a formula developed by Kothari (2004:179) and recommended by Cohen et al., (2007:104) in educational research was used. Since, this formula has been practically tested and used by scholars for more than four a decade, the researcher considered the formula to correctly determine appropriate sample size for this study.

$$n = \frac{Z^2 * p * q * N}{(e^2 (N-1) + (Z^2 * p * q))}$$

Where:

n= the required sample size

Z2 = is the abscissa of the normal curve that cuts off an area α at the tails (1- α equals the desired confidence level. The value for Z is found in statistical tables which contain the area under the normal curve. e.g., Z=1.96 at 95% confidence level; and Z 2 =3.841).

N= the population size (1,281)

P= the population proportion (assumed to be 0.5 since this would provide the maximum sample size)

q= 1-p e = is the desired level of precision or margin of error (5% error or 0.05)

Thus;

$$\frac{3.841 * 0.5 * (1-0.5) * 1,281}{(0.05)^2 (1281-1) + (3.841 * 0.5 * (1-0.5))} = 296$$

= 296 sample size from the population

From 296 people are involved to achieve the objective of the perception of the employee's/community on effects of lead on environment and human health. 286 respondent collected from five paint factories employee and 10 respondent collected from Environment forest and climate change commission (EFCCC) experts where selected randomly. Global paint Factory where have 36 peoples, Nefas Silk Paint Factory where have 162 peoples, Rainbow paint Factory where have involved 10 peoples, Kadisco Paint Factory where have involved 62 peoples, Zhi bin Wang Paint Factory where have involved 16 peoples relatively (proportionally) to their population size.

3.4. Methods of Data collection

Data was generated from both primary and secondary data to achieve the objective of the study.

3.4.1. The primary data

To obtain information for assessing the management practice of lead release and factors affecting the practices of management in Addis Ababa, close and open-ended questionnaires were used to collect primary information. The questionnaire was being tested at the pilot scale and then improved before it was fully interred for data collecting. This was being done to avoid ambiguity, and redundancy of words, in turn, to improve clarity and understanding. The questionnaire was dispatch to the organization or the sample respondent. Key informants were interviewed about the institutional policy and regulatory framework management practices of lead in paint and also directs observation was to see practically how the management look like in the sampled of Non - governmental paint companies.

Laboratory Analysis

To assess the status and variation of quantity of lead in paint industries in Addis Ababa. The laboratory analysis was conducted by following laboratory testing procedures and the obtained data were be analyzed with the national regulation threshold level.

(A) The sample was taken from Nifas silk paint factory, kadisco paint and Adhesive P.L.C., Zhibin Wang Paint Industry, Rainbow Paints Industries and Sons industry P.LC(Global paint industry). The results was expressed in parts per million (ppm).

For evaluating the lead content in paint, there are three main approaches:

- 1) Using a chemical test kit, test the paint for lead in situ.
- 2) Use an AAS (Atomic Absorption Spectrophotometer) Agent system to measure the amount of lead in paint in situ.
- 3) Collect a sample of paint and measure its lead content using different analytical techniques in a laboratory.

Methods and procedures for analyzing lead in paint

Atomic Absorption Spectrometer (AAS) is used to determine the amount of lead in paints. Lead compounds were applied as pigments, anti-corrosive additives, and drying agents in paints. As a result, paints used for metal protection, decorative finishes, or to speed up the drying of oil-based paints include a significant amount of lead in our environment.

The effects of lead poisoning include decreased neuromuscular activity, retarded mental development, reduced ability to learn, other extremes, death, and environmental health impacts.

The aims of this experiment to collect and to determine the levels of lead in the paints industry, to which our environment and also young children are exposed. Based on the lead contents, the risk of exposure was being assessed, and recommendations were made on the future actions to be taken.

1. Experimental procedures

To undergo laboratory analysis, twelve paint samples were collected: three paint samples were collected from three painting industries: Nifas silk paint factory, Zhi bin Wang Paint Industry and Sons industry P.L.C (global paint industry) and also two paint samples were collected from Kadisco paint and Adhesive P.L.C, one sample was collected from Rainbow Paints Industries and a sharp stainless steel knife or spatula and a clean dustpan or sheet of paper were used to collect samples. Scrape 2-5g of unbroken, peeling, or cracking paint film then transferred to a clean sheet of aluminum foil or plastic bag, label and note were sealed in the following details: Appearance of paint (intact; peeling; chipping), Colour of paint, age of paint film, Sample preparation for analysis, Each sample were set at 130° in an oven for at least one hour, Cooled, grinded finely in a mortar, and shacked through sieve provided (note mesh size used), then triplicate aliquots of each paint (~0.2g) were weighed into boiling tubes, and add 10mL conc. nitric acid to each. an acid blank was prepared and tube were covered with a clean glass plate and allowed to pre-digest overnight at room temperature in a fume hood overnight. Next to these it was digested at 120°C for 3h., with occasional swirling to avoid bumping, then cooled and diluted with 100mL distilled water and mix well. Then after 100 mL filtered into volumetric flasks using Whatman #41 filter paper, and make up to mark with distilled water residue washings.

2. Lead determination

Atomic absorption Spectrophotometry with Pb hollow cathode lamp and set wavelength of detection at 283.3nm for air-acetylene flame mode of analysis made setup. And 25mL volumes of lead standards prepared, using the 100ug/mL stock standard provided: 0.5, 1.0, 2.0, 4.0, 8.0, and 10ug/mL and Aspirate standards, noting the absorbance for each solution, finally aspirated samples and blank solutions and note absorbance. If the absorbance of the sample solution exceeds that of the 10ug/mL Pb standard, dilute immediately and reanalyze.

3. Calculations/Calibration

Construct a calibration curve and determine sample solution concentration.

Calculate the sample solution concentrations by determining the linear regression equation and correlation coefficient.

As a result, weigh the Pb concentration of paint samples. %, after accounting for all sample dilutions.

Finally the sample was predigested at 40 C⁰ for 20 minutes using HNO₃ to eliminate organic solvents followed by digestion at 120 for 3H using 5 ml HCl and 1ml HF in block digestion. The Digested sample was being filtered with Whatman filter paper 41. The filtrates transferred 100ml volumetric flask filled to the mark with high-quality distilled water. Then the reading with 400P analytic Jena Atomic Absorption Spectrophotometer (AAS) using both flame and graphite method as required.

Key Informant Interview

Key informant interviews represent a conversation between paint factory's technical workers to acquaintances, allowing ideas and knowledge to flow freely. Interviewers spontaneously frame questions, probe for information, and take notes. The interview were conducted to investigate their management Practice regarding what they use, import, how to prepared the internal waste management regulation guideline and how to provide the personal protective equipment for employee's within each paint factory's that was investigate by the helps of prevention of industrial pollution control regulation number 159/2018 and Hazardous Waste Management and Disposal Control Proclamation number 1090/2018. those question answered by two experts from

each painting industry's and its implications particularly and supplement the findings obtained through it. The key informant interview were conducted for selected from the administration level to experts in order to succeed the objective of the current management practices and determinates of lead in paint.

Field Observation

Observation of the different paint industry where carried out before and during the study period. Prior to collecting data, different painting industry were visited to know the means of lead use, management practices including disposal site and status of the paint industry. Information regarding people's which working in painting industry's trends where obtained from personnel observation and by talking formally with peoples in their paint industry. Field observation has helped to validate some of the research results. In order to achieved the current management practice and determinates of lead in paint for each factory's by using checklist where primary used to evaluate the statues of the painting industry.

Social Survey

To generate quantitative information about the perception of the community/paint factory's employee's about the impact of lead in paint on health and environment. Surveys were undertaken by developing structured questionnaires.

A questionnaire were chosen as the data collection instrument. A questionnaire is a printed form of self-designed to collect information that can be gathered from the subjects' written responses.

The data obtained through a clothed ended questionnaire is equivalent to that obtained through an interview, but the questions appear to be less detailed (Burns & Grove 1993). Data where to collect with the aid of questionnaires to evaluate the perception and attitude about the impact of lead in paint from the paint industry's technical workers, sellers/paint distributors and the local community end users, Day labor and others.

There are five paint factory's and environment forest and climate change commission (EFCCC) where 296 peoples involved to achieve the objective of the perception of the community on the effects of lead on health and environmental.

Table 3.1. Proportional Sample Size N=296

No	Organization	Number of population	Sample size
1.	Environmental, forest and climate change commission	44	$44/1,281 \times 296 \approx 10$
2.	Nefas Silk Paint Factory	701	$701/1,281 \times 296 \approx 162$
3.	Kadisco Paint Factory	267	$267/1,281 \times 296 \approx 62$
4.	Global Paint Factory	154	$154/1,281 \times 296 \approx 36$
5.	Zhi bin Wang Paint Factory	70	$70/1,281 \times 296 \approx 16$
6.	Rainbow Paint Factory	45	$45/1,281 \times 296 \approx 10$
Total sample Size			296

Source: own survey, 2021

They ensured a high response rate as the questionnaires were be distributed to respondents to complete and could be collected personally by the researcher.

- It took less time and resources for them to prescribe.

They provided the possibility of anonymity because, on the questionnaires, subjects' names are not required.

- There were less opportunity for bias as they were presented in a consistent manner.
- Most of the items in the questionnaires could be closed, which made it easier to compare the responses to each item.

3.4.2. Sources of secondary data

A secondary source of information was reviewed to supplement the primary sources of information. Various documents available were reviewed and used to generate a secondary source of information. Moreover, books, journals, articles, different GOs and NGOs documents, legal documents and publications, and academic research papers could be reviewed to understand the effect of heavy metals' environmental pollution and Management Practices in the Case of Lead in Paint.

3.5. Methods of analysis and Interpretation

Data for this study was generated through qualitative and quantitative methods. Hence, qualitative and quantitative techniques were used to analyze data. Information that were generate from key informant interviews, survey and personal observations could be analyzed qualitatively. The quantitative data generated from the paint seller, Day labors, technical works staff & others survey were coded and entered into the computer for analysis. Hence, the descriptive analysis and inferential analysis in this study were analyzed using computer software, Statistical Package for Social Sciences (SPSS) version 20.

Binary Logistic Regression

Logistic regression is useful for situations in which where we want to be able to predict the presence or absence of a characteristic or outcome based on values of a set of predictor variables. It is similar to a linear regression model but is suited to models where the dependent variable is dichotomous.

Logistic regression coefficients can be used to estimate odds ratios for each of the independent Variables in the model. Therefore we have binary outcome from the did you think Lead in the paint will Affect human health and its application also (yes, no).

Let the dependent variable Y is dichotomous (categorical variable) with two categories and x_1, x_2, \dots, x_k are independent variables. The Binary logistic regression model were be fitted as follows:

$$\text{Log}(\pi/(1-\pi)) = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_p x_p$$

Assumptions:

Logistic regression assumes meaningful coding of the variables: it is difficult to interpret if the variables are not coded meaningfully. In binomial logistic regression, the dependent class of interest is coded as 1 while the other class is coded as 0.

Firstly the dependent variable were categorical. Than the groups must be mutually exclusive and exhaustive; every instance can only belong to one of the groups, and each case must be a member of at least one of the groups.

The dependent and independent variables are not assumed to have a linear relationship in logistic regression. The logit form of the dependent variable should have a linear relationship with the logit regression equation. Because maximum likelihood coefficients are big sample estimates, larger samples are required than for linear regression.

The Wald Statistic: The Wald statistic is an alternate test that is widely used to determine the significance of each independent variable's logistic regression coefficient. In a logistic regression model, this means testing the null hypothesis that a certain logit coefficient is 0. If for a particular explanatory variable or group of explanatory variables, the Wald test is significant, then we would conclude that the parameters associated with these variables are significantly different from zero, so that the variables should be included in the model.

The Hosmer and Lemeshow Test Statistic: The Hosmer and Lemeshow goodness-of-fit statistic, which assesses the correspondence between the actual and predicted values of the dependent variable, is the last measure of model fit. The Hosmer and Lemeshow test is a widely used test for determining a model's goodness of fit. It accepts any number of explanatory variables, which can be continuous or categorical. In this case, better model fit is indicated by smaller difference in observed and predicted classification (Bewick, et al, 2005).

This chapter includes the presentation, analysis, and interpretation part of the data collected from primary sources. The main objective of this study is to know and examine the perception of the community on the health and environmental impacts of lead in paint.

Herby to fill full the intended objectives of the study, the researcher collected data through a questionnaire, an experiment from the source which exists in Addis Ababa. In addition, the Statistically package for social sciences SPSS version 20, which helps the researcher to convert the activity data of the organization into environmental release and table, graphs, charts have been applied to analyze the data.

Not only has this binary logistic regression analysis been applied to analyze the data.

Chi-square test, the variables those who has significant (p-value) less than 0.05 included in the logistic regression model.

The Chi-Square test is a statistical procedure used by researchers to examine the differences between categorical variables in the same population.

The Chi-Square test is most useful when analyzing cross tabulations of survey response data.

Because cross tabulations reveal the frequency and percentage of responses to questions by various segments or categories of respondents (gender, profession, education level, etc.), the Chi-Square test informs researchers about whether or not there is a statistically significant difference between how the various segments or categories answered a given question.

Dependent variable is defined as a categorical variable to include high and low critical thinking levels.

Reason of selection of the variable were

- Coefficients biased away from zero.
- Standard errors that are too small and confidence intervals that are too narrow.
- Test statistics and p-values that do not have the advertised meaning.

Definition and Description of variables

This study included variables of the impacts of lead in paint, paint factory employees, and income. Here under these variables are defined and described.

- **Dependent variable:** the dependent variable refers to for the impacts of lead in paint on health and environment.
- **Independent variables:** The independent variables were select based on the existing theories and empirical studies. The definitions of these select explanatory variables are given below.
- **Age (age):** Here refers to the respondent's age in years.
- **Gender (gender):** in this study household head is male a dummy value „1“ or whether the paint factory employee female is value „0“.
- **Education in years:** By level of literacy in this study is a dummy which refers to whether the respondent is literate (sixteen years in education Values of „1“ were assign for literate) or illiterate (not sixteen years in education is value „0“).
- **Number of children:** in this study house ownership is a dummy value „1“ which refers to

whether the respondent does not have child „0“.

- **Monthly income:** Here price refers the employee can received the monthly income from the five paint factory employers

3.6. Ethical consideration

Informed consent to participate in the study was obtained from respondents. The confidentiality of information obtained from respondents and the anonymity of respondents were protected.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Chemical Analysis results of lead in paint in Addis Ababa Paint

Manufacturing: status and variation

Sample were collected from Nefas Silke paints (white, orange for home, and red color for enamel), Kadisco paints (white for home and white for enamel), Zhi bin wang Paint Factory (pink, orange, and red colors for home), Rainbow paints (green color for home) and Global paint (Blue, yellow for home and White for enamel). According to Ethiopian proclamation number 429/2018 the restriction law that import, use, export, wholesale, and distribute of lead in paint prohibited above 90 parts per million (ppm). Based on the laboratory analysis result of the medium paint factories they use lead directly or indirectly as input. This shows that the factory purposely imported lead raw material for making paint. The result of the lead (Pb) in paint content showed in the table 4.1.

Table 4.1. Lead Concentration by color of solvent-Based and Enamel Decorative paints for five different painting factories

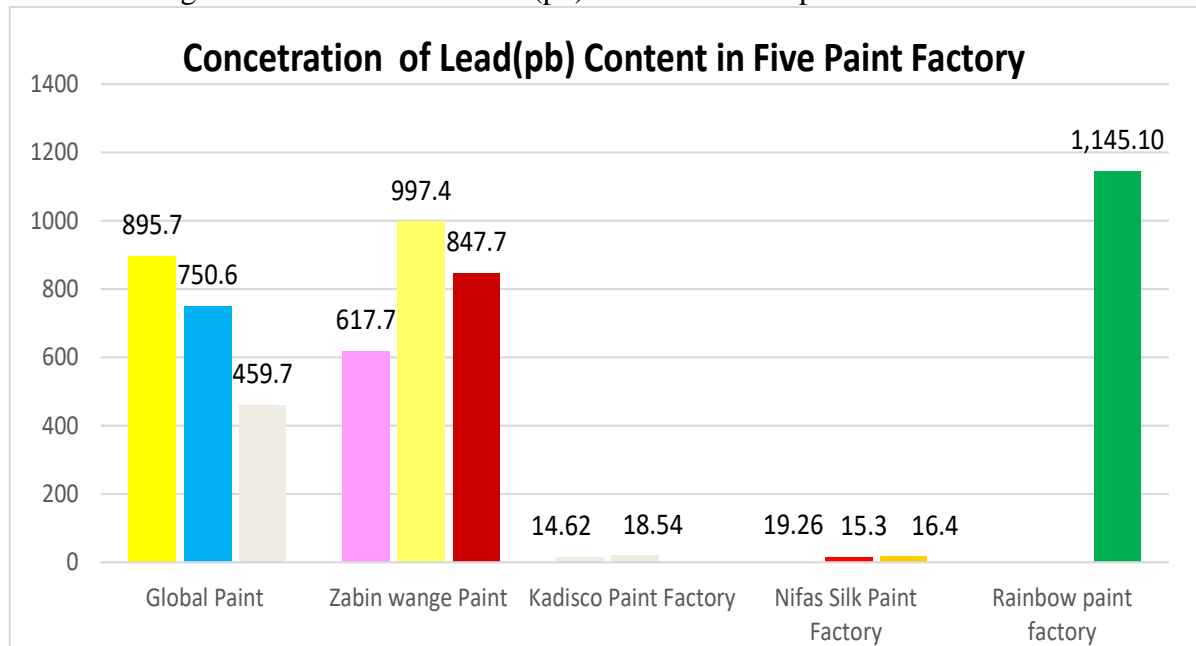
<i>No.</i>	<i>Industry</i>	<i>Paint brand</i>	<i>Paint colors</i>	<i>Sample code</i>	<i>Laboratory result/ ppm</i>
1.	Sens P.L.C	Global Paint	Blue	G1	750.6
			Yellow	G2	895.7
			White Enamel	G3	459.7
2.	Green trees plc.	Zhi bin Wang paint factory	Light Yellow(home)	Z1	997.4
			Light pink (home)	Z2	617.7
			Red (home)	Z3	847.7
3.	Kadisco paint factory plc.	Kadisco Paint Factory	White for home	K1	18.54
			White for Enamel	K2	14.62
4.	Nefas silke paint factory plc.	Nefas Silk Paint Factory	White for Home	N1	19.26
			Yellow for home	N2	16.4
			Red for Enamle	N3	15.3
5.	Rainbow Paint Factory	Rainbow paint factory	Green for home	R1	1,145.1

From five paint brands, there are three factory-produced paints with a lead contents of above 90 parts per million (ppm). However, for Consumer Information except for Global paint factory the rest painting factory does not label and carried information about the type and amount of ingredients including the amount of lead.

Among five paint factories, there are three factories of the paints in this study that would not meet the standards set by the regulation number 429/2018. From the total of 12 color samples, there are 7 paints sample collected from Zhi bin Wang, Global Paint and Rainbow paint factory (58.3 %) the lead content was greater than 90 ppm.

Basically, in this study there are two paint brands are producing low lead content. Those are Nifas silk and Kadisco paint industry have (41.7 %) of the samples contained lead levels below 90 ppm, demonstrating that the technology and ingredients are available to produce paints with low lead levels.

Figure 4.1. The status of lead (pb) content for five paint industries



Source: own experimental result, 2021

Based on the above result the number of finding can support this study findings by (IPEN, 2017 and UNEP 2019) mentioned that, the maximum limit of lead in the paint not more than 90 parts per million (ppm). Due to the above maximum lead content in paint, the number of impacts can be influenced on human health and the environment. Many nations always have high levels of lead in their paint. More than 100 studies published since 2009 have found that lead paint is still

commonly distributed in low- and middle-income nations. The majority of the paints tested for lead exceeded above the standard level of 90 parts per million (ppm), which has been set as a feasible maximum by various countries. Furthermore, while developed countries have put in place regulations to limit the use of lead in paint, most paint supplied for household use in underdeveloped countries includes high levels of lead. According to a recent study analyzing lead contents in paint in African countries such as South Africa, Tanzania, Nigeria, and Senegal, 68 percent of new paints tested exceed the US standard of 90 parts per million similar outcomes have been reported in research undertaken in India, China, and other nations.

Poisoning from lead paint is entirely preventable, and we advise all governments that lack strong lead-paint legislation to engage with relevant parties and pass legislation prohibiting the use of lead paint.

Based on the finding of the study, the highly concentration of lead in paint children are take paint chips or contaminated soil due to hand to mouth behaviors. This study supported by the finding of (UNICEF and Pure Earth 2020), (Rosenthal, Lanphear, and Gottesfeld 2015; WHO 2020a), (Aizer and Currie 2019; Mielke and Zahran 2012; UNICEF and Pure Earth 2020; Reyes 2007), mentioned that, Lead poisoning can have a variety of negative health effects, some of which are very dangerous, especially in children under the age of six and under the content of the lead easily entered to internal organ by ingestion and inhalation, that was affect IQ and learning capacities, as well as increased behavioral issues.

Based on the result of the finding, by the lack of enforcements on regulatory institution most of the painting industries are using lead in paint for making paint and other function. this study supports the findings by (WHO,2010 and WHO, 2020), In many countries, regulatory limitations on a variety of sources of lead exposure have been shown to safeguard public health, as seen by lowering population-level blood lead concentrations. Primary prevention in environmental public health is demonstrated by the elimination of lead paint through appropriate legislation. This initiative also serves as a paradigm for the removal of other chemical toxicants that have an impact on the world's population.

4.2. Management practices and Their Determinants of lead in paint industries

The Large and medium scale Paint manufacturing sector are located in Addis Ababa in different part of the sub city, most of them were concentrated in the residential and commercial area such as Nifas silk lafto sub city and Akaki Kality sub city. The study reported that there are different paint factories producing paint with high lead content.

To understand the management practices of lead in paint within the paint factory, the information was gathered through an interview by taking experts from each paint industry and field observation to know and evaluate the processes, practices, and challenges of the following factories.

- 1) Global Paint Factory
- 2) Rainbow Paint Factory
- 3) Nifas silk paint Factory
- 4) Kadisco paint Factory
- 5) Zhi bin wang Paint Factory

Global paint industry

According to the Privation of Industrial Pollution Regulation number 159/2008 and hazardous Waste Management and Disposal control proclamation number1090/2018 mentioned that, any industrial should be prepared their Owen treatment plant however, based on the field observation the Global painting industry has no treatment plant but most of the chemicals by-products are recycled for making new paint, whereas some solid waste was damped without any treatment plant. This is the major problem that was observed during the field visit at the factory. From interviewee respondent mentioned that, the factory has a plan to construct a treatment plant and solid waste management in the near future.

During interviewee respondent and field observation, the global paint industry has no monitoring and evaluation system of environmental pollution for the release of lead (Pb) and other hazardous waste substances into the environment. In addition, it was observed that, the factory does not conduct regular training for its employees about the use of personal protective equipment. With regards to the data on lead in paint and other hazardous wastes, it was learnt

that the factory does not keep any report or document related to the hazardous waste and lead-by product.

Privation of Industrial Pollution Regulation number 159/2008 mentioned that, any industry should have to prepare their own internal waste minimization guideline in order to minimize the risk of hazardous waste exposure and effective implementation, however, Based on field observation, there is no internal regulation document to manage hazardous waste and Lead-by products. But during process description, material safety data sheet, sampling plan, analytical result were prepared and also all chemical are well labeled by global paint manufacturing company. With regard to lead-in paint products, this painting industry labeling the word free of lead with all paint brands. These method is very important for the prevention and creating awareness to the community to know the impacts of lead in paint.

Finally, during interviewee respondent and from field visit observation, it was found that, the elimination of lead-related hazardous chemicals disposal sites or treatment plants is not properly implemented by global paint manufacturing company. In this regard, it has been observed that the waste products are not supported by various technologies, and also it has been learned that, employee at this Paint Factory would be given gloves, mouth and nose masks but those protective equipment are using only for cleaning purpose. I would like to point out that remedial action should be taken as this method of removal or poor treatment can expose to unwanted health problems, be said this, the company must focus for their employee by giving rubber gloves to protect themselves from health-related problems.

Rainbow Paint Factory

Rainbow paint industry usually uses calcium carbonate as input for making paint. According to the interviewee respondent stated that, precautionary measures are taken by the company, and the factory does not release the polluting chemicals including lead by-products into the environment.

Regarding sewage disposal, the factory initially prepared soil treatment plant to treat sewage disposal. This paint company was instructed by Addis Ababa Environmental Protection Authority to construct treatment plant with a better performance and standard. However, the factory failed to construct as per the recommendation by Addis Ababa Environmental protection authority (EPA) and currently runs with poor standards. Based on the above result, this paint

factory did not adoration the legal requirement set by Privation of Industrial Pollution Regulation number 159/2008 and Hazardous Waste Management and Disposal Ccontrol proclamation number1090/2018.

Interims of lead exposure, the company still provides the necessary protective equipment such as the mouth and nose masks and gloves for their employee, but those protective equipment are not sufficiently provided by this paint factory.

According to privation of industrial Pollution Regulation number 159/2008, any industry should have to pared their Owen internal waste management guideline, Interims of lead and other hazardous chemicals this paint factory currently they does not prepared internal waste management guidelines document. With regard to the use of lead, the respondent stated that, the company does not use lead as an input to make paint product and also, expired chemicals are identified and disposed of as the following necessary disposal procedures.

During the interviewee respondent stated that, it was noted that the company did not provide any reports to Addis Ababa environment protection authority(EPA) on the handling of lead by-products and hazardous chemicals and also did not provide any lead-related training to their staff or management to know about the impacts of lead poisoning and health related hazards issues.



Picture 4-1 The Rainbow paint factory treatment plant

Finally, it was observed from the factory, it is clear that the elimination of lead-related hazardous chemicals issues is not concerned on rainbow painting factory for better management practice, and also treatment plant does not focus and addressed on this paint manufacturing factory. In this regard, it has been observed that the waste products are not supported by various technologies, in addition to this the workers of the company add chemicals to the end processing wastes and caring the various jar to release in to the environment. This method that causes vulnerable for employers health-related problems and the entire environment.

Nefas silk paint Factory

Respondent explaining that there are six's chemicals are used as inputs to produce dyes in the Nefas silk paint factory. Those are Acrylic, Alkyd and Epoxy polymers, Latex (PVA), Phenolic, and Chlorinated rubber. The respondent were mentioned that, basically, the factory use silicate titanium oxide as a false pigment, as well as aluminum silicate and various chemicals used as inputs.

The light pigment is the result of the combination of four compounds those are: - Pigment, Solvent, Dryers, and Adhesives. Based on the interviewee respondent explained that, to use false pigment aluminum silicate is used for extensions, on this regards this factory use water for dyeing, and also uses kerosene for solvent to produce pigment for enamel or metal paints.

According to interviewee respondent mentioned that, two years before the factory restricted to use lead-based chemicals input for paint production and also the factory follows the 90 ppm threshold level and their factory respects the maximum allowable level of lead in the paint set by the regulation number 429/18, and interviewee respondent explained that, the factory only imports lead-free raw materials and use them as inputs.

According to the respondent stated that, the company use Zero Net Waste Minimization Principal for water-based paints as well as enamel or metal paint by-product for the release of waste which coming out from this paint factory. In this regard, it was observed through field visit, after the production of the light-colored products, the remaining waste was washed in the prepared containers and transported to the Waste Treatment area with the help of advanced technology. Beside this, this paint factory usually used a tertiary treatment plant which means

they use manual, biological and chemical treatment plant in order to reduce the exposure of environmental pollution.

According to privation of industrial Pollution Regulation number 159/2008 mentioned that, any factory should have to prepare emergency response plan for reducing the exposure of environmental pollution. So that, this paint factory highly follow and respect the procedure which set by the regulation. Beside this, the environmental unit prepared by the painting factory to implement lead and other hazardous waste management principle being implemented. The factory has well organized waste minimalizing plan and environmental unit document. It is a general guideline to implement the disposal of the end chemical processes in the enterprise for reducing the environmental pollution. In this regard, during the process until the production, the factory follows mixing technology (Bach process methods). There are three processing methods those are continuous, semi-continuous, and Bach processing methods. The Bach processing method is a large bump in progress through the assembly flow because multiple parts are being treated at once.

According to the Hazardous Waste Management and Disposal control proclamation number 1090/2018 mentioned that, any paint factory should have to provide personal protective equipment for their employee, based on field observation, Nefas silk paint factory provides face masks, hand gloves, and protective shoes for their employee to protect health-related problems.

Based on regulation to control lead in paint number 429/2018 mentioned that, any paint factory should have to labeled the amount of lead concentration on their paint brand. However Nefas silk paint factory does not label the amount of lead (Pb) content or free of lead with all paint brands. This factory is planning to label its products after a laboratory test on the near future.

According to the interviewee respondent, the factory does not use the expired chemical as input because the raw materials are always checked by internal and external regulatory experts or officers coming from environment forest and climate change commission & chemicals and construction impure institute to evaluate the status of the painting industry.

Based on the interviewee respondent stated that, interims of Environmental pollution the factory does plan to protect the environment from the waste generation problems and also Addis Ababa environmental protection authority (EPA) is the other relevant institution who quarterly monitors

and evaluate to test paint sample in order to know the level of lead in paint for future correction measurement. Besides this, these paint factories have an extension paint factory around the gelan area this shows that, this paint factory focus and establishing an environmentally friendly industry.

Within this paint factory, from a total number of production around 70% is water-based paint this means that the solvent is water. Based on the above explanation the impacts of the chemical by-product and other hazardous waste the vulnerability on human health and environmental pollution are very low.

Finally, the factory facilitating training for their selective department about the impacts of lead and related hazardous chemicals and also, the factory intended to given personal protective equipment to their employee to protect against health-related problems. The factory usually willing to open to checked external environmental audit this shows that the company focusing on environmental concerning issues.

Finally, during interviewee respondent and field observation, it was observed that the treatment plant was well constructed and proper management practices were put in place to reduce lead by-product and other hazardous chemicals waste.

Kadisco Paint Factory

Kadisco Paint Factory is one of the leading and experienced manufacturers of paint in various Asian countries. The interviewee respondent stated that, the factory did not use lead (Pb) as input for making paint. Basically the Company produces two types of paints, wall paints, and metal paints. Based on the interviewee respondent mentioned that, the storage of lead, lead (Pb) by-products, and hazardous chemicals related wastes are treated by supporting different technology. The storage of other chemicals such as powders, Alkyd polymers, Epoxy polymers, Latex (PVA), Phenolic resins, Chlorinated rubber would be stored in a warehouse.

According to the respondent, Kadisco paint factory usually used cola us input for making paint. The company produces 35,000 liters of paint /per day the remaining small amount of paint can be stored and puts in a container to use for other paint production.

Based on the respondent mentioned that, the company has their own waste minimization internal regulation documents and the employee would be provided gloves as well as mouth and nose masks before entering in to hazardous chemical compartments.

Based on field visit observation and interviewee response, lead is not used in any dyeing process, and it is understood that the factory managers preparing the report and would give it to Head Quarter Technical Officials in India every month to show how many solvents used and amount of disposal waste within the factory. According regulation to control lead in paint 429/2018 mentioned that, any paint factory should have to label the amount of lead concentration on their paint brand. However, Kadisco paint factory did not labeling by word whether the amount of lead applied in the paint brand or not.

Regarding on the issues of training, the employee and management officials have not received any internal and external training about the impact of lead and other hazardous chemicals problems on health and environment.

Finally, during the field observation, it was observed that the tertiary technology would be processed at various chemical waste stages until it converted into nonhazardous soluble-water type. Based on privation of industrial Pollution Regulation number 159/2008 mentioned that, any factory should have to prepare emergency response plan and waste management guideline for reducing the exposure of environmental pollution. From the above issues, this paint factory prepared pollution prevention plan and emergency response plan has been in place since in 2009 E.C for protecting the environment and human health impacts. Beside this, this paint factory highly follow and respect the procedure which set by the regulation and the factory focusing on using environmentally friendly technology for making and eliminate harmful chemicals to the environment and human health.

Zhi bin Wang Paint Factory

Zhi bin wang paint factory is one of the chain's companies located around the lebu area.

According to the respondent mentioned that, there is no lead content used and import for making paint, this factory used cola and other chemicals for making paint. Besides this, the factory only

imports lead-free chemicals inputs to making paint and also, the input of the paint is checked by internal chemical analysis experts.

According to privation of industrial Pollution Regulation number 159/2008 mentioned that, any factory should have to prepare emergency response plan and hazardous waste management guideline for reducing the exposure of environmental pollution. However the interviewee respondent mentioned that, there is no internal waste management regulation document under the organization to manage lead-related and other hazardous chemicals within painting factory.

According to the Privation of Industrial Pollution Regulation number 159/2008 and hazardous Waste Management and Disposal control proclamation number 1090/2018 mentioned that, any industrial should have to prepared their Owen treatment plant, however, based on the field observation the factory has established a very poor treatment plant and also, released their hazardous waste in to the environment which generated from this paint industry.

According to regulation to control lead in paint 429/18 and Hazardous Waste Management and Disposal Control Proclamation No. 1090/2018, mentioned that, the factory does not follow the restriction procedures to reduce chemical-related waste and also this paint industry does not label the amount of lead content or concentration on their each paint brand. But the good said of the factory, marked all hazardous chemicals storage containers with the word hazardous chemical.

Based on the field observation, this paint factory does not have monitoring and evaluation system to know the status of the paint factory and there is no providing sufficient and efficient personal protective equipment for their employee to minimize the risk of hazardous chemicals.

In this regards, the factory does not have a recording system for each hazardous waste generated chemicals. However, this painting industry does not use expired lead as input for making paint. Finally, the factory does not have a well-prepared treatment plant besides this, these paint industries release lead-by products and other hazardous chemicals into the environment which may cause very serious environmental and human health problems.

Summary management practices of paint factories

Hazardous waste management systems in paint factories lack a systematic approach to administering waste management programs, as well as the ability to properly collect and manage

wastes while reducing the negative impacts of such actions. However the divided and mandate overlap responsibilities across governmental organizations, there are shortcomings in the implementation of hazardous waste management, Hazardous waste treatment and final disposal are not effectively addressed by the Zhi bin wang, Rainbow, and Global painting industry. Regarding the management practice of lead from the above five painting manufacturing industries like Kadisco paint and Nefas silk paint factory's, one of the experienced and have well-organized factories to providing with supportive advanced technology, personal protective equipment, material data sheet are indicated on their organization. However, Global paint, Zhibin wang paint, and rainbow paint factory have lacked their own supportive technology and have poor treatment plants. Besides this, those paint factories' lacks awareness creation training to their employees about the impacts of lead and other hazardous chemicals, these may have the major factors that affect the management practices of lead and other hazardous chemicals.

This idea supports the findings by (Patwary, et al, 2011) stated as, hazardous waste landfills in many developing countries faces significant challenges, including social acceptance, regulatory, technically skilled manpower, financial resources, limited technology, and the provision of such infrastructure. While landfill is the least preferred option on the waste hierarchy, it is recognized that it will need to be considered for some non-recoverable or noncombustible hazardous wastes.

Based on the assessment of the paint sample laboratory result, the global paint, Zabin wang, and rainbow paint factories have the maximum level of lead (Pb) content within their paint brand compared to Kadisco paint and Nefas silk factory, this shows that how the medium paint manufacturers must be needed strictly followed up by the concerned regulatory bodies for effective management practices. Because of the hazardous nature of the material, the handling of hazardous wastes in developing countries is exacerbated by a lack of comprehensive legislation and regulations. This idea supports the findings of (GU, B.et al, 2014), Disruptive activities and insufficient disposal procedures are increasing major health concerns and pollution during the processing and disposal of hazardous waste.

Previous research studies have shown that, including waste generators, regulators, decision-makers, waste processors, and the informal and formal sectors, is a primary driver of hazardous waste management. These stakeholders play a crucial role in strengthening the system by ensuring the creation and delivery of an effective and efficient hazardous waste management

program studied by (Couto, N.et al, 2013 and GU, B.et al, 2014) but this study are contradicted to our finding because the stakeholder including environmental concerned body did not strictly regulated the management practice of lead by-product and other hazardous wastes.

From our find Zabin Wang, Global and rainbow paint factory usually follow the procedure of low supportive technology and uncontrolled facility using an old disposal methods. This idea supported the findings by (Patwary, et al, 2011) stated that the majority of hazardous materials are managed at uncontrolled facilities using traditional methods such as waste disposal. The balance of the waste material is processed in facilities that are permitted to utilize low technology and low-environmental-standard treatment procedures.

This suggests that in the developing country industry, comprehensive strategies for hazardous waste recovery are needed to lower the rate of disposal of these wastes in communal landfills and to encourage resource recovery and recycling of valuable materials from these wastes. As a result, high-technological solutions must be developed, as well as recovery and recycling centers and hazardous waste management techniques that are environmentally, socially, economically, and technically feasible (Mmereki, D., et al, 2016). This idea supports our finding like Kadisco and Nefas silk paint factories have the advanced technology with supportive manual, biological and chemical treatment plant and also they have the method of using recovery and recycling hazardous waste with in the paint factory in order to provide environmentally, socially, economically, and technically feasible.

Based on the finding of our study there is the lack of advanced technology on our painting industry to trite hazardous waste including lead by product and other hazardous chemicals. Idea supports the findings of (Olukunle, et al, 2015) Due to a lack of technically qualified staff and health and safety specialists, there is no monitoring of the health and environmental dangers associated with these practices, like Zabin Wang, Global and rainbow paint factory lack health and safety specialists are not available on this paint's factory because of this problem the employee are exposed by lead waste and related hazardous chemicals.

From our study finding, Kadisco and Nefas silk paint factory used nanotechnology in order to reduce the exposure of environmental pollution, this idea supports the findings of (Saeed Farrokh, 2011) the current problem in the paint and coatings industry is to use advanced

technologies like to create environmentally friendly and long-lasting coatings. In today's paint industries, nanotechnology is used in a wide range of applications. Environmentally friendly applications, such as waterborne systems, are expected to continue to be areas where development will be made.

Nonetheless, there is a lack of information and knowledge about the quantities of industrial hazardous waste, where it is generated, and how it is disposed of. The quantities of industrial hazardous waste (IHW) will continue to rise due to the rapid development of economies, mass manufacturing and processing industries, and less stringent environmental quality assessment standards. Beside this privation of industrial pollution regulation number 159/2008 stated that any industry must provide training about the impacts of hazardous chemicals on environment and human health to protecting from the hazardous chemicals and to reduce the mixing of nonhazardous chemical to the hazardous one. however Zabin Wang, Global and rainbow paint factory does not providing training about the impacts of lead by-product and other hazardous chemical exposure for their employee's, this Idea supports the findings by (Olukunle, et al, 2015), Meanwhile, in developing countries, it has been confirmed that a significant amount of hazardous waste is still mixed with nonhazardous waste, primarily through landfilling, resulting in serious environmental consequences in terms of heavy metals and persistent organic pollutants in landfills leachate because of lack of knowledge.

According to privation of industrial pollution regulation number 159/2008 stated that, any industry must be prepared their Owen hazardous waste internal management guideline document for protecting the environment and to reduce the mixing of nonhazardous chemical to the hazardous one. However, Zabin Wang, Global and Rainbow paint factory did not have internal waste management guideline this study supports the findings by (Mmereki, D. et al, 2016) underdeveloped countries lack precise rules for industrial hazardous pollutants. Furthermore, there are no Hazardous Waste Management Plans or Authorized Facilities in developing nations to manage, treat, and eliminate hazardous waste. In developing countries, there is no practice of separating all waste streams for possible waste reuse. This suggests that policies aimed at encouraging industries, commerce, and societies to manage hazardous waste sustainably, encouraging the shift from traditional waste management practices to modern management practices, and reducing the problem of hazardous waste management, are urgently needed.

This recommends that, a variety of rules and new techniques to manage the content of these potentially hazardous and damaging compounds should be established to prevent the Radioactive and hazardous wastes have public health and environmental consequences.

By the lack of protective equipment most of the paint factories are exposed by unwanted health problem. From the finding of interview and field visit observation, Zabin Wang, Global and Rainbow paint factory does not providing personal protective equipment for their employees who working on the processing and production area. The painting factory employees are the most exposed by health impacts or enhanced unwanted health problem. This study supported by the finding report of (Occupational Safety and Health Administration, 2004) the most prevalent way for lead to enter the body is by inhalation or ingestion. Lead is absorbed into the body by worker's lungs and upper respiratory system when they breathe it in as dust, fume, or mist this happened by lack of providing personal protective equipment. If lead enters the mouth and is swallowed, it can also be absorbed through the digestive system. Lead circulates through the body and is stored in numerous organs and bodily tissues after it enters the bloodstream. If the body takes more lead than it excretes, the quantity stored increases as exposure continue. Lead accumulated in tissue can cause irreparable harm to individual cells, organs, and whole biological systems over time. Although severe lead poisoning has largely common in many countries, occupational lead poisoning resulting in moderate to clinically symptomatic poisoning is still widespread. Adults who come into direct touch with lead in manufacturing operations are more likely to be exposed. Many industries, including the paint industry, motor vehicle assembly, panel beating, battery manufacture, and recovery, soldering, lead mining, and smelting, lead alloy production, and the glass, plastics, printing, and ceramics industries, expose workers to lead due to the lack of protective equipment. Occupational lead exposure is often unregulated in underdeveloped nations, with no monitoring of exposure.

This study supports the findings by to Wolford et al, 1997, a study conducted under a cooperative agreement between the Center to Protect Workers' Rights (CPWR) and the National Institute for Occupational Safety and Health (NIOSH) on a comparison of Safety-and-Health Training of Painters in Alaska, Oregon, and Washington, safety and health training improves painters' self-protective behaviors, such as the use of respirators and fans. Trained employees

appear to be better at protecting themselves from toxic substance exposures, lowering the chance of major and costly long-term work-related health impacts for themselves and their children.

Manufacturers of paint are unable to offer accurate information on product material safety data sheets, product datasheets but lack product labels to consumers or their workers without identifying chemical identity. As a result, they feel that effective, compliant hazard communication is impossible and less protect themselves from unwanted exposure, this study sporting from our findings by (Tim and Vesela, 2004) Based on our study the management of lead in the painting industry compared to the above finding, the five painting industry's like Zabin Wang, Global and Rainbow, Nikas silk and Kadisco paint industry have organized martial safety data sheet and product data sheet but they did not labeled the amount of lead concentration on their paint brand.

Due to their unique circumstances, countries may face different degrees of various obstacles. According to reports, Malaysia has no official regulation on internal hazardous waste, and the current management approach emphasizes the usage of final treatment and disposal systems over the precautionary principle. One of Malaysia's most serious hazardous waste management issues is a lack of listing and identification hazardous waste (A.F. Mohamed, et al, 2008). Compared to our study Ethiopia have good Hazardous Waste Management and Disposal Control Proclamation No. 1090/2018 document, but there is a lack of implementation problem from a different governmental body, because of this problem many painting industry that may release hazardous waste, that may cause different impacts on the health, environmental concern.

According to the report, Taiwan not only has to improve hazardous waste import, export, and transshipment management procedures and other regulatory frameworks but also lack strong coordination across authorities to put control strategies in place (H.J. Hsing, et al, 2004). This study is the same as in the Ethiopian context it is very bad management of hazardous waste and lack of institutional follow up in accordance with management, monitoring, and evaluation systems.

4.3 Perception of community on the impacts of lead in paint

4.3.1 Socio-economic and Demographic of the respondents

4.3.2 Response Rate

As it is described in the methodology part, primary data are used for this study were gathered from the organization that is responsible for the release of lead. The following table summarized the total respondent rate along with the returned.

Table 4.2 Response rate of the questionnaire

Respondent	Distribution questionnaire	Returned questionnaire	Response rate %
296	296	296	100

The above table 4.2.demonstrate that from the total of 296 respondents, 100% of respondents returned the questionnaire, this indicates that the returned questionnaires are sufficient enough to carry out the analysis.

Knowing sex, age, education level, living area, position, income, and organization of the respondents helps to set their composition and flexibility and their inclination to change. The following table presents the demographic composition of the respondent directly related to the activities emitters' organization.

Gender

In the above table 4.3. 61.8% of the respondents were males while 38.2% of respondents were females. Provided that the questionnaires were distributed in different areas of the paint factory's and government offices. where relatively equal proportion of male and female were thought to be found, the considerable difference in their numbers shows the disparity in their eagerness to discuss what they perceive concerning the perception of the community about the impacts of lead in paint.

Table 4.3 socio economic and demographic characteristics of the respondent (n=296)

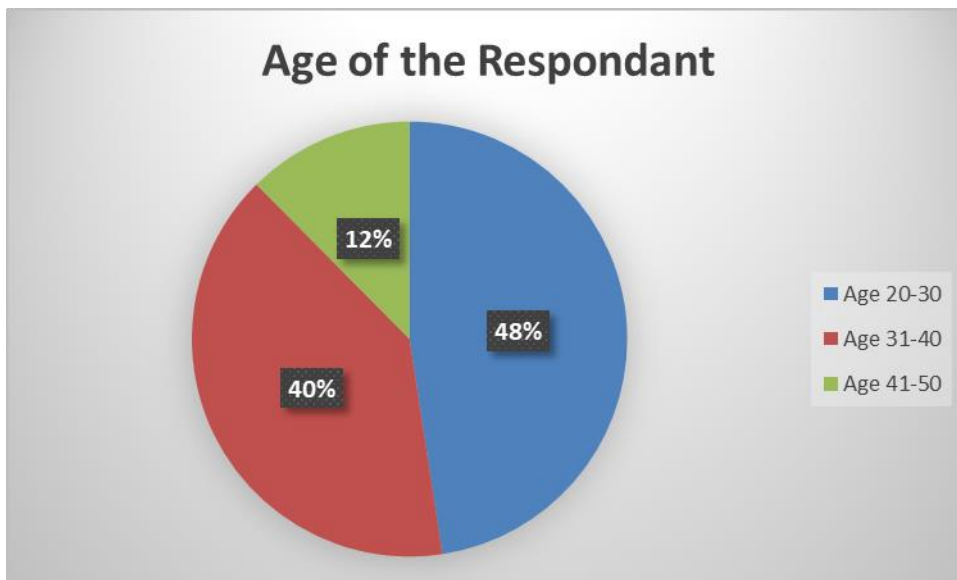
Gender	Frequency	Percent
Male	183	61.8
Female	113	38.2
Total	296	100

Source: own survey, 2021

Age

48% of respondents indicated that in an age of 20-30 years and 40% in the age of 31-40, and also 12% respondents were in the age of 41-50 years. Their appearance in such a way implies that the young were more willing to explore answer the impacts of lead in paint on environment and health than the old. The researcher, in the course of collecting the data found some old men and women lacking willingness to fill the questionnaires provided to them and passing them to the young found nearby.

Figure 4.2. Age of the Respondent

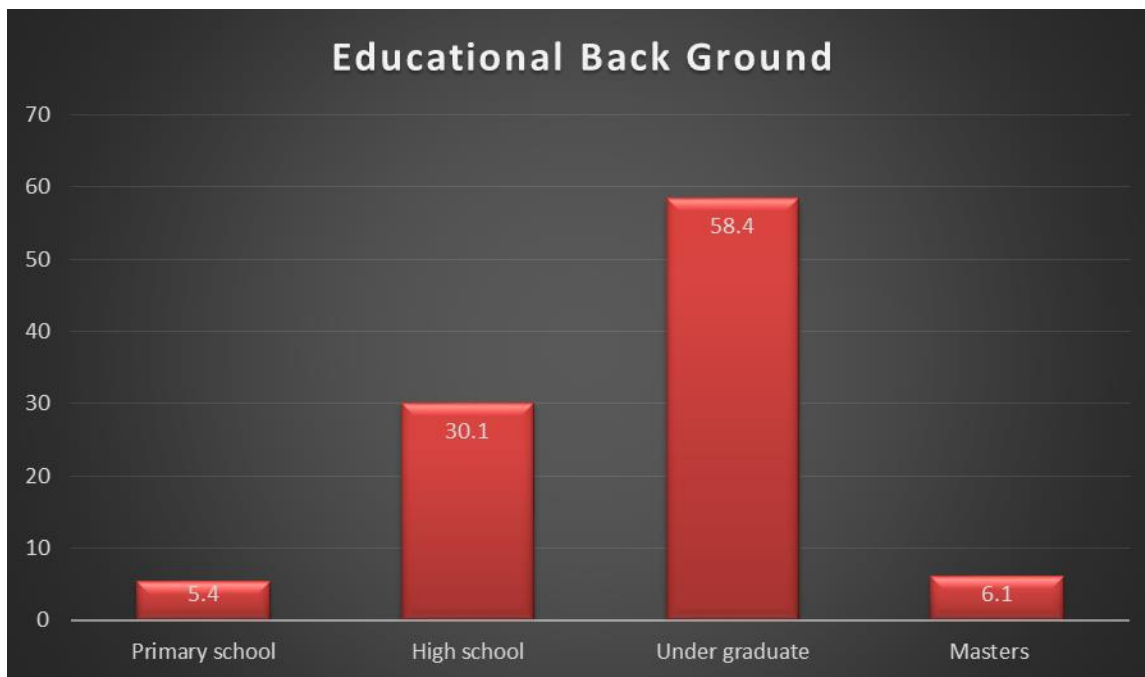


Source: own survey, 2021

Educational Status

The research incorporated educational status of respondent as an important demographic attribute. The levels of education, here, are classified in to four categories(primary, high school, under graduate, masters level) Regarding the educational background of the respondents, 58.4% of the respondents with first-degree holders, and 5.4% participants were with primary, high school 30.1%, and 6.1% master's level of the educational level.

Figure 4.3. Educational status of the Respondent



Source: own survey, 2021

Religion

Regarding religion, 62.2% of respondents responded that they are following the Orthodox religion, and other respondents responded that they are following Muslim 15.5 %, protestant 6.1%, and other religions 16.2%.

Table 4.4 Religious Affiliation of the Respondents

	Frequency	Percent
Muslims	46	15.5
Orthodox Christians	184	62.2
Protestants	18	6.1
Others	48	16.2
Total	296	100

Source: own survey, 2021

Occupation

The type of job people are involved in is one of the socio-demographic attribute this research has considered. In doing so, the research endeavored to discover the ways livelihood activities shape the perception of the respondent on the impacts of lead in paint. With regards to the working position, 11.8 % of the participants were technical workers, Environmental protection authority (3.38%) and 17.9 % of the respondent was merchant, 22.9% and 44.5% Day Labor and End users, working position of respondents were set respectively.

Table 4.5. Occupation of the Respondents

Variables	Categories	Paint factory	Response	Frequency	Percentages
Working position	Paint industry technical workers	Nefas Silk Paint Factory	20	35	11.8
		Kadisco Paint Factory	7		
		Global Paint Factory	6		
		Zhibin Wang Paint Factory	1		
		Rainbow Paint Factory	1		
	Merchants(paint distributes)	Nefas Silk Paint Factory	30	53	17.9
		Kadisco Paint Factory	9		
		Global Paint Factory	9		
		Zhibin Wang Paint Factory	3		
		Rainbow Paint Factory	2		
	Day labor in paint factories	Nefas Silk Paint Factory	36	68	22.9
		Kadisco Paint Factory	11		
		Global Paint Factory	12		
		Zhibin Wang Paint Factory	6		
		Rainbow Paint Factory	3		
	End users	Nefas Silk Paint Factory	76	132	44.5
		Kadisco Paint Factory	35		
		Global Paint Factory	9		
		Zhibin Wang Paint Factory	6		
		Rainbow Paint Factory	6		
Environmental protection authority			10	10	3.38
Total					100

Source: own survey, 2021

Living Area

Relatively 58.1% of the proportion of the respondent have been living in Akaki kality sub-city, followed by Yeka sub-city (20.3%) and 7.8%, 1.7%, 2%, 6.1%, 4% of participants were who has been living in kirkos, Nifas silk lafto, Gulalle, Bole sub-city, and Addis ketema city respectively.

Table 4.6. Living Area of the Respondent

Living Area	Frequency	Percent
Kirkos	23	7.8
Nifas silk lafto	5	1.7
Gulalle	6	2.0
Bole	18	6.1
Akaki kality	172	58.1
Yeka	60	20.3
Addis ketema sub city	12	4.0
Total	296	100

Source: own survey, 2021

Also similarly 36.1% of respondents indicated that a person who has one child per household, followed by a person who has two children per household (35.5%) and others 16.2%, 8.1%, 4.1% of participants indicated that a person who has no child, three and four children per household respectively.

Table 4.7. Number of children per respondent

Number of children	Frequency	Percent
0	48	16.2
1	107	36.1
2	105	35.5
3	24	8.1
4	12	4.1
Total	296	100

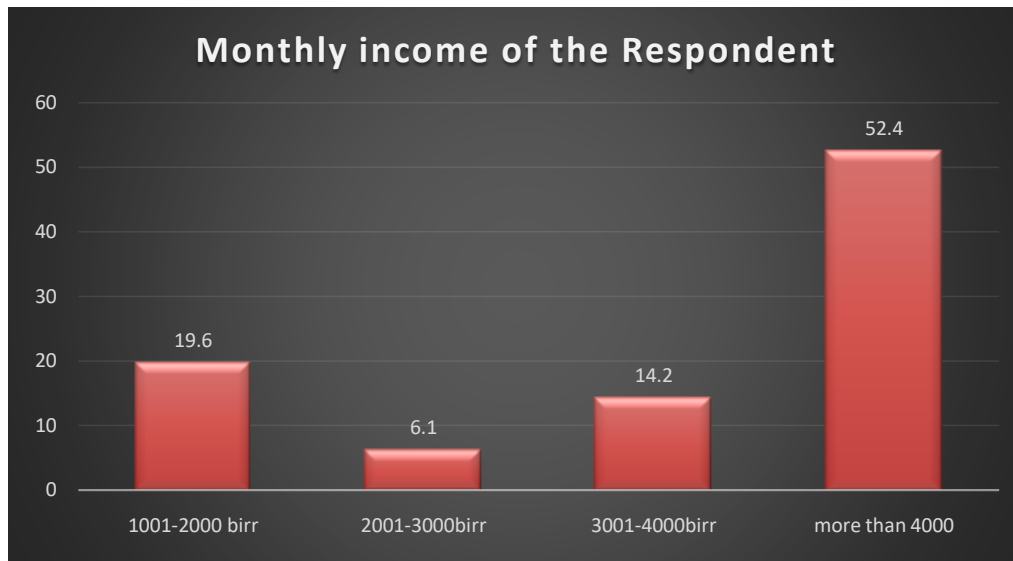
Source: own survey, 2021

Monthly income

The average monthly income of the respondents was used as one of the study's the main independent variables to examine its function in changing the community perception of the

effects of lead in paint. Lastly, the respondents earned an average monthly income of between 1001-2000ETB (19.6%), the monthly income of the respondent 3001-4000 (14.2%), 52.4% of respondents indicated that a person who has more than birr 4000 monthly salary and followed by a person who having birr 2001- 3000 monthly salary (6.1%).

Figure 4.4. Monthly income of the Respondent



Source: own survey, 2021

4.3.3 Knowledge of the community on lead in paint: nature of the problem, cause and effects, and legal issues

In this section, the analysis of the primary data which were gathered during the fieldwork is presented based on the objectives of the study.

As shown in **table 4.8:** regarding the hark before about lead, 76 % of the respondent indicated they didn't know about the meaning of lead while 24% responded they know the meaning of lead (Pb). However 63.9% respondent shows that they do not aware of the source of lead and 36.1% of participants were aware of the source of lead. This indicated that they don't aware of the impact of lead in paint on health and the environment. As shown in Table 4.8: 45.9% of respondents indicated that they don't know the importance of lead in paint because they responded neutral which means they neither agreed nor disagree, and others 10.1% strongly

disagree, 12.2% disagree, 21.6% and 6.1% agree, strongly agree on the importance of lead in paint. And also 67.9% of respondent responded that their children's usually plays with toys and related materials whereas 32.1 of the respondent that their children's not usually used plays with toys and related materials. This indicated that children are vulnerable to affect by lead in paint.

1. Knowledge of the nature of problems

Table 4.8 Views of community on the Nature of problems

Variables	Responses	frequency	percentage
Do you hark before about lead?	No	225	76.0
	yes	71	24.0
Do you hark before about source of the lead?	no	189	63.9
	Yes	107	36.1
Do you think the importance of lead in paint?	Strongly disagree	30	10.1
	Disagree	36	12.2
	Neutral	136	45.9
	Agree	64	21.6
	Strongly agree	18	6.1
Does your children usually play with toys and related material?	No	95	32.1
	yes	201	67.9

2. Cause and effects of lead related

From the Table 4.9 shown in Result, 28% of respondents agreed that the impact of lead on health and the environment while 72% of respondents did not hear about the impact of lead in paint on health and environment. This shows that they don't know the impact of lead in paint on their health and environment. As it is shown in table 4.9 95.9% of respondents responded that they don't check the labeled brand of paint where the lead level is applied or not during purchased it while 4.1% of participants responded that they checked it. The results in table 4.9: 69.6% of the respondent indicated that they have not used safety equipment like a facemask, hand gloves when they are doing paint smear for their home while 30.4% of respondents used it. 95.9% of respondents indicated that they have not tested the blood of their child for lead within the last 12months while 0% of respondents tested the blood of their child and 4.1% of respondents missed it. 76% of respondents responded that their child doesn't live with an adult or doesn't have contact with an adult who works with lead while 17.9% of participant agreed that their child lives with an adult or have contact with an adult who works with lead. 55.4% of respondents indicated that they had kids under the age of six years and out of the 57.4% of

respondents agreed that they ever seen their children usually put paint chips or soil in their mouth while 18.2% of the respondent said that, they children did not take any soli or paint chips on their mouth and 38.5% of respondents responded that they had no kids under the age of six years. The majority of the respondent (29.1%) responded that neutral on their kid has bad behavior while 28.4% of them disagree, 18.2% of them strongly disagree, 12.2% of them agree, and 4.1% of the respondent indicated strongly agreed that their children have bad behavior. As it revealed in above table 4.9: the majority of the respondent (40.5%) shows that they have agreed the important check children's blood lead and lead excretion while 27.4% of them neutral, 10.1% of the strongly agreed and the left disagree on the importance of children's blood check for lead.

Result shown in table 4.9: the majority of the respondent (86.1%) indicated that they have not ever been trained or educated by the minister of health or environmental protection office about countermeasures against the impacts of lead accidents while 13.9% of respondents responded that they trained or educated against of lead accidents. And also the majority of the respondent responded they are agreed that the paint industry is not serious about environmental and health problems, the governmental authority has not taken proper action against the impacts of related lead accidents in the past, and the paint industry not using appropriate technological regimes using modern equipment and machinery.

Table 4.9 cause and effects of lead problem related

Variables	Responses	Frequency	Percentage
Do you mark the impacts of lead in paint on health and environment?	no	213	72.0
	yes	83	28.0
Do you checked the labeled brand of paint where the lead level are applied or not during purchased it?	no	284	95.9
	yes always checked	12	4.1
Do you used the safety equipment like facemask, hand glove when you are doing paint smear for your home?	No	200	67.6
	Yes	90	30.4
Has your child's blood been tested for lead within the last 12 months?	No	284	95.9
	Yes	0	0
Does your child live with an adult or have contact with an adult who works with lead?	No	225	76.0
	Yes	53	17.9
Does your kids had under the age of six?	No	114	38.5
	Yes	164	55.4
If yes to the above question, have you ever seen your children usually put paint chips or soil in their mouth?	No	54	18.2
	Yes	170	57.4
Do you think that does your kid have bad behaviors?	Strongly disagree	54	18.2
	Disagree	84	28.4
	Neutral	86	29.1
	Agree	36	12.2
	strongly agree	12	4.1
Do you think it is important to check children's blood lead and lead excretion?	Strongly disagree	29	9.8
	Disagree	24	8.1
	Neutral	81	27.4
	Agree	120	40.5
	strongly agree	30	10.1
Have you ever been trained or educated by minister of health or environmental protection office about counter measures against the impacts of lead accidents?	No	255	86.1
	Yes	41	13.9
Do you think that paint industry company is serious about environmental and health problems?	Strongly disagree	72	24.3
	Disagree	83	28.0
	Neutral	93	31.4
	Agree	36	12.2
	strongly agree	12	4.1
Do you think the governmental authority has taken proper action against the impacts of related lead accidents in the past?	Strongly disagree	66	22.3
	Disagree	77	26.0
	Neutral	123	41.6
	Agree	30	10.1
	Strongly agree	0	0
Do you think about, paint industry using appropriate technological regimes using modern equipment and machinery?	Strongly disagree	54	18.2
	Disagree	100	33.8
	Neutral	76	25.7
	Agree	66	22.3
	Strongly agree	0	0

3. Legal related factors

From the results Table 4.10: 90.2% of respondents indicated that they don't know the regulation to control lead in paint while 9.8% of them know the regulation to control lead in paint. This shows that the majority of the participant are don't know the regulation to control lead in paint.

As shown in Table 4.10 indicated that majority of the respondent (82.1%) they don't know about the compliance office to control lead in paint in Addis Ababa city while 17.9% of respondent have information about the compliance office in Addis Ababa city. As it is shown in table 4.10, the majority of the participant (90.2%) agreed that they don't have information about the government has banned the use of lead in paint above 90 ppm and the majority of the respondent (88.2%) responded that they don't have information about the proclamation requires that any paint manufacturer be required to post lead-free paint on their paints brand and almost all of the respondent (98.3%) indicated that they have no ever paid extra for a lead-free paint product.

Table 4.10 legal related results

Variables	response	frequency	Percentage
Do you know the regulation to control lead in paint?	no	267	90.2
	Yes	29	9.8
Do you know about the compliance office to control lead in paint in Addis Ababa?	no	243	82.1
	Yes	53	17.9
Did you know that the government has banned the use of lead in paint in excess of 90 ppm?	no	267	90.2
	yes	29	9.8
Did you know that the proclamation requires that any paint manufacturer be required to post lead free paint on paints?	no	261	88.2
	yes	35	11.8
Have you ever paid extra for a lead-free paint product?	no	291	98.3
	yes	5	1.7

4.3.6 Logistic regression fitted model

Table 4.11 Goodness of fit test

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	7.304	3	.063

The above table output shows that the model is significant since the non-significance of the Hosmer and Lemeshow test indicates the significance of the model. I.e. The Hosmer-Lemeshow statistic indicates a poor fit if the significance value is less than 0.05. Here, the model adequately fits the data.

Table 4.12 Parameter estimates of model

Parameter Estimates						
Variables	B	Std. Error	95% Wald Confidence Interval		Wald test	Sig.
			Lower	Upper		
(Intercept)	-169.870	2.2906	-174.359	-165.381	5499.713	.000
Gender						
Male	-56.197w	.5573	-57.289	-55.104	10168.433	0.000
Age						
20-30	99.122	1.8796	100.438	102.806	2.78	.070
31-40	-78.663	2.1496	-77.876	-74.450	1.158	.820
Education level						
Primary school	361.647	3.3237	355.133	368.161	11839.532	.000
High school	212.859	1.7966	209.337	216.380	14036.870	.000
Undergraduate	172.777	1.6254	169.591	175.962	11299.349	.000
Monthly income						
500-1000	-109.505	1.8406	-108.112	-105.897	3.658	.530
1001-2000	-88.984	1.2133	-87.361	-86.606	5.209	.110
2001-3000	-84.976	1.2139	-83.355	-82.597	4.519	.320
3001-4000	25.953	1.0441	23.907	28.000	617.864	.000
Number of children						
number of children per house	99.327	.9459	97.473	101.181	11027.241	.000
Hark before about lead						
No	126.568	1.1805	124.254	128.882	11495.996	.000
Hark before about source of the lead						
No	113.567	1.2161	111.950	115.183	8720.226	.000
Children usually play with toys	0 ^a					
No	-29.609	.8021	-31.037	-28.181	1362.773	.000
Safety equipment						
No	49.889	.9561	48.015	51.763	2722.741	.000
Child live with have contact with lead						
No	-139.157	1.1992	-141.507	-136.806	13466.269	.000
Kids under age six						
No	34.616	.5773	33.484	35.747	3595.473	.000
Ever been trained about impact of lead						
No	217.279	2.0000	213.359	221.199	11802.219	.000
Know regulation to control lead						
No	118.397	2.2871	113.915	122.880	2679.971	.000
Know about compliance office						
No	42.877	.6287	41.644	44.109	4650.981	.000
Know 428/2018 regulation						
No	61.980	2.5276	57.026	66.934	601.284	.000
Ever paid extra a lead free						
No	441.580	3.9432	433.308	-449.851	12540.405	.000
Dependent Variable: The impacts of lead in paint on health and environment?						

As shown above, the meaning of a logistic regression coefficient is not as straightforward as that of a linear regression coefficient. While B is convenient for testing the usefulness of predictors, $\text{Exp}(B)$ is easier to interpret. The ratio change in the probabilities of the event of interest for a one-unit change in the predictor is represented by $\text{Exp}(B)$. For example, $\text{Exp}(B)$ for the gender of the respondent is equal to $\exp(-56.197)$ which means that the odds of the impact of lead on health and environment for a male respondent are $\exp(-56.197)$ times the less likely to odds of the impact of lead on health and environment for a female respondent, all other things being equal. This means female respondents are more likely than males to agree on the impact of lead in paint on health and the environment.

In general, if the significance level of the Wald statistic (which tests the effect of individual predictors while controlling other predictors.) is small (less than 0.05) then the parameter is useful to the model.

As it is shown in table 4.12 the positive coefficient of predictors are more likely to odds of impact lead in paint on the health and environment when we compare them with their corresponding reference category and the negative coefficients of the predictors are less likely to odds of impacts of lead in paint on the health and environment when we compare them with their corresponding reference category. With regard to the number of children in the household, this variable is a continuous variable, so as the number of children increases by one the logit of the impact of lead in paint on health and environment is increased by 99.3 factors holding the other effect as constant.

With regarding the educational background of respondents: the number of respondents who have been agreed on the impact of lead in paint on health and the environment increased by 361.6, 212.7, and 177.7 factors as Primary school, high school, and undergraduate levels of educations were increased by one unit when we compare with masters level of education category. Also as compared to more than birr 4000 monthly income when a person who had 3001-4000 birr monthly income is increased by one unit change the logit of the impact of lead in paint on health and environment is increased by 25.9 factors holding the effect of others as constant.

As it is shown in Table 4.12 indicated that the respondent they didn't know before about lead in paint $\exp(126.5)$ times more likely than that they did know about lead in paint on the health and environment. The odds of the impact of lead in paint on health and environment for those who didn't know the source of lead are $\exp(113.5)$ times more likely to the odds of the impact of lead in paint on health and environment for those who did know the source of lead. The odds of the impact of lead in paint on health and environment for respondent those their children don't play with toys and related material are $\exp(-29.5)$ times less likely to the odds of the impact of lead in paint on health and environment for those their children usually play with toys and related material.

As shown in Table 4.12: The odds of the impact of lead in paint on health and environment for those who have not used safety equipment like a facemask, hand glove when you are doing paint smear for your home are $\exp(49.88)$ times more likely to the odds of the impact of lead in paint on health and environment for those who have been used safety equipment like a facemask, hand glove when you are doing paint smear for your home. The odds of the impact of lead in paint on health and environment for those their child live with not an adult or have not contact with an adult who works with lead are $\exp(-139.15)$ times less likely to the odds of the impact of lead in paint on health and environment for those their child live with an adult or have contact with an adult who works with lead. The odds of the impact of lead in paint on health and environment for those who have not kids under the age of six years are $\exp(34.6)$ times more likely to the odds of the impact of lead in paint on health and environment for those who had kids under the age of six years holding the effects of others as constant.

As shown in Table 4.12: The odds of the impact of lead in paint on health and environment for those who have not been trained or educated by the minister of health or environmental protection office about countermeasures against the impacts of lead accidents are $\exp(217.2)$ times more likely to the odds of the impact of lead in paint on health and environment for those who have been trained or educated by the minister of health or environmental protection office about countermeasures against the impacts of lead accidents. The odds of the impact of lead in paint on health and environment for those who didn't know the regulation to control lead in paint are $\exp(118.3)$ times more likely to the odds of the impact of lead in paint on health and environment for those who did know the regulation to control lead in paint. The odds of the

impact of lead in paint on health and environment for those who didn't know about the compliance office to control lead in paint in Addis Ababa are $\exp(42.8)$ times more likely to the odds of the impact of lead in paint on health and environment for those who did know about the compliance office to control lead in paint in Addis Ababa.

As it is shown in table 4.12 The odds of the impact of lead in paint on health and the environment for those who didn't know that the government has banned the use of lead in paint above 90 ppm are 0% times more likely to the odds of the impact of lead in paint on health and environment for those who did know that the government has banned the use of lead in paint above 90 ppm. The odds of the impact of lead in paint on health and environment for those who didn't know that the proclamation requires that any paint manufacturer be required to post lead-free paint on paints are $\exp(61.98)$ times more likely to the odds of the impact of lead in paint on health and environment for those who did know that the proclamation requires that any paint manufacturer be required to post lead-free paint on paints. Lastly, the odds of the impact of lead in paint on health and environment for those who have not paid extra for a lead-free paint product are $\exp(441.5)$ times more likely to the odds of the impact of lead in paint on health and environment for those who have paid extra for a lead-free paint product.

Lead exposures from numerous sources (e.g., lead in paint, water, industrial emissions, and past gasoline) must be addressed from a population health and health equity perspective, but policies and lead education initiatives pay little attention to them. Second, until now, lead prevention initiatives have mostly focused on addressing lead exposures. For example, rather than examining and treating lead in the environment, current policies largely treat children as indicators of lead in the environment. Third, the long-term effects of lead exposures, as well as disparities in lead exposures, point to the need for increased awareness in policy implementation and evaluation, with an emphasis on health equity. The parts that follow explore the limits of current lead policy and point to promising paths for preventing lead exposure and reducing and finally eliminating lead-related health disparities (LeBrón, et al, 2019).

The over all of the survey result study, epically people who using paint like end users, day labor, merchants or paint distributors they did not have or they have very little knowhow about the impacts of lead in paint on health and environment. This idea supports the findings of (Adebamowo, E.O, et al, 2006), many of them were unaware of the presence of lead in paint and

had little awareness about domestic sources of lead exposure, such as paint, water, and soil. Most of the community misunderstood the general public's perception of lead in paint. Because of a lack of information from the government body, several of the community were unaware of the dangers of lead exposure from paint manufacturing companies. Participants in the survey were also aware of the existence of lead in some alternatives in association with professions. Some of the participants were aware of the dangers of lead poisoning in infants, suggesting that it could be the cause of "abnormal conduct" and "dullness." The community mentioned that there is a need to raise community awareness about lead poisoning. Many people agreed, however, when another participant suggested that people are likely to be pragmatic in their response to any campaign to reduce lead exposure, implying that alternative sources of income should be found for those whose occupations are likely to be affected by lead remediation activities, or such campaigns will fail.

From the result of the survey study, around 57.4% of the respondent's children usually put paint chips or soil on their mouth and 12.2% of the respondent's their children had bad behavior. This result supports by the findings of (CDC, 2019) due to greater absorption levels, developmentally appropriate hand-to-mouth activity, and child more likely to suffer from birth abnormalities, mental retardation, or behavioral issues, as well as brain development, children are particularly exposed to the health effects of environmental lead. Even though no level of lead is safe for young infants.

Despite attempts by the WHO to reduce lead exposure in children, lead poisoning continues to be a problem in both developed and developing countries. Lead poisoning has long-term repercussions on children's health, academic performance, and behavior. Even in small amounts, lead can cause physical harm and is linked to learning and behavioral disorders. While blood lead levels (BLLs) have continued to fall in industrialized countries, there is still a variation in a race and socioeconomic class. Lead is still a major health threat in poorer countries with marginalized populations, where 90 percent of children have higher lead levels. Lead exposure causes a loss of IQ points across the population, resulting in lower productivity and earnings potential (Susan M. Schultz, 2014).

According to the survey result, around 90.2 % of the respondents they don't have an information about the regulation to control lead in paint. This study supports the findings by (Eugenious O, et al, 2006), in Nigeria, there is little or no enforcement of a minimal threshold for lead content in the social environment. This is attributed in part to a lack of awareness of the health implications of these exposures and there has never been any domestic lead abatement in Nigeria.

Based on the survey result around 96% of the respondent did not check their children blood lead level for the last 12 months and they did not have information before about the relevance of checking children blood tests, and 90.2% of the respondent does not have a piece of information about government ban lead in paint to use an excess of 90 ppm, however, this study contradicted from the findings by (Xuemeng Sun, et al, 2018) China has made significantly informed and encourage their citizen to check their children blood test for prevention and control of blood lead concentration, particularly people who living on the area of environmental construction. China emphasizes strongly promotes it to raise people's understanding of the need for environmental conservation. Furthermore, to reduce pollution, China has enacted several regulations and policies, including the elimination of lead in paint, leaded gasoline, and other clean energy sources, many of which have produced impressive results.

Based on the result of the survey around 86.1% of the respondent they did not been trained or educated by ministry of health or environmental protection office about counter measure against the impacts of lead accident. This study argues the findings by (Xuemeng Sun, et al, 2018) As a result, local regulatory policies developed an awareness creation for their peoples to limit lead emissions from numerous local lead-related sectors and to promote regional renewable energy growth, as well as to emphasize blood lead screening in children aged 0–6 years old and children's health care. Meanwhile, the Chinese government has been implementing the "egg milk project" in kindergarten and primary schools for many years, enhancing children's nutrition and effectively reducing lead poisoning.

CHAPTER FIVE

CONCLUSION and RECOMMENDATION

5.1. Conclusion

The general objective of this study was to assess the management practices of lead release and factors affecting the practices of management in selected paint manufacturers in Addis Ababa Ethiopia.

To obtain the required information, the writer was dedicated to seeing the listed specific objectives of the study. Those research questions were responded to a different data source methods such as primary and secondary data sources, data collection methods such as questionnaire, interview, field observation, and data analysis such as statistical package social science and different legal documents like council of minister regulation to control lead in paint number 429/2018 and Ethiopian hazardous waste minimization proclamation number 1090/2010 and different international lead elimination standards spreadsheet, Excel program and tables, and charts were employed by this research.

All this research the content was digested to produce an outcome; therefore the following issues were concluded on the relay on the research question. Therefore, the first objective of the research is to assess the status and variation of quantity of lead in paint industries in Addis Ababa. Based on the laboratory examination there are still many decorative and enamel paint manufacturing industries in Ethiopia that produced paint with high lead content and at levels hazardous to the environment and human health specially for children.

According to laboratory results, from five paint factories three of them found Lead in the paint at or above the allowable level. Accordingly, seven color samples from three factories were found above 90 ppm lead content and the rest two paint factory have less lead content within their paint brand. Regarding this, it was discovered that the paint factories did not receive a certificate of lead-free input from the importer company when importing inputs. By these specific problems, the content of lead is above the standard level and, it may cause harm to children especially at the age of six and under. Besides this, the remnant lead by-products out from the paint factory deteriorate human health and the entire environment.

Based on this, the management practice of lead in paint in five factories identified for the import, sell, use and release lead with mixing with other by product chemicals in the study area. It has been conducted through Interview and checklist used to achieve the above objective. Interims of the management practices of lead in paint from those five factories like global paint industry, Zhi bin Wang paint and, Global paint and Rainbow paint industry has a very weak hazardous waste management practices and they have no completed treatment plant with weak disposal site.in addition to this, the above factories have no internal waste management guideline to avoid lead by-product or others hazardous chemicals. Beside this, they did not sufficiently provide personal protective equipment and training for their employee. Kadisco paint factory and Nefas silk paint factory have advanced technology to treat waste chemicals or by-product which out from those paint factories. In addition to this, those factory provide well prepared protective material and giving training for their employee. Because of the previous three painting factory had weak management practices, the entire environment can be polluted from a chemical released out from those industries that may cause acritical health, socials, and environmental impacts.

Based on our result, the Perception of our community about the impacts of lead in paint is very low this may cause serious impacts for children, adults, employee or community as well as the entire environment. Due to the gaps of exposure to knowing the impacts of lead in paint. The main problem is that, because of a lack of information from the government body, paint factory higher officials and not only the high level of lead in the paint but also the high level of ignorance in the community about the presence of lead in the paint.

5.2 Recommendation

While conducting this research, several gaps were identified in the Status and Effect of Heavy Metals' Environmental Pollution and Management Practices in the paint industry. Thus the following recommendation forwarded concerning the objectives of the research for further improvement of the Managements practices of lead in paint factories or organizations as well as for the country. According to the Ethiopia regulation number 429/2018 stated that, any person shale does not manufacture, import, export, wholesale, and distribute paint with a total lead Concentration higher than 90 parts per million but this restriction is not satisfactory to control lead in paint. A country like America and most European countries that banned a concentration of lead since 1978.

Our county must take a lesson from the above country's to control the content of lead in paint from any paint factory.

Specifically, Environment, forest, and climate change commission should have set the standard or the reviewed regulation for achieving the elimination to used, import, export wholesale, and distribute lead content from any paint factory. Lead by nature has a high atomic number that may cause cancer, kidney and reproductive failure, mental retardation for kids, so there is no safe level for affecting human and environmental health. Besides this, the commission must be crate the demonstrable mechanism for effective implementation in order to assure Safe human health and the entire environment.

Any paint factory should have to reduce and check the raw material or input before making paint, or if it is possible the manufacturing should willing to eliminate the contents of lead emission by themselves. The global paint factory, Zhi bin Wang paint, and Rainbow paint manufacturing company have very weak waste management practices and have no well-prepared treatment plant for liquids as well as solid wastes, this may pollute and affects human health and environmental distortion. Therefore Environment, forest, and climate change commission (EFCCC) should have to establish strong monitoring and evaluation system to check effective implementation statutes for all paint manufacturing companies.

The above painting manufacturing companies should have to take a lesson from Nifas silk paint factory and Kadisco paint factory to build assembled and followed technological options to caring and solving environmental and human health problems.

Ethiopian Standard agency should have to check paint samples coming from any paint industry and based on the laboratory result the agency should have given a certificate for their paint industry. This method is very crucial for monitoring and evaluation status of the paint factory whether the paint industry follows the compliance of the reviewed regulation or not.

According to World Health Organization estimating that, Lead poisoning is a global public health concern that contributes 0.6 percent of the global burden of disease. Children are at the most risk of lead poisoning and the health effects of poisoning are more severe in children who are still developing. The typical sources of lead exposure to children include soil, air, water, toys, cosmetics, batteries, putty, cement, canned foods, jewelry, and paints, paint chips especially from houses painted are the main source. Children under the age of six years are particularly at risk because of their frequent hand-to-mouth and object-to-mouth behaviors which expose them to toxicity by ingestion.

Currently, the world faced a critical problem by lack of awareness that to reduced and eliminate the above problem Ministry of Health, environment, forest and climate change the commission, ministry of trade and industry and other responsible bodies should have to create awareness by using mass media, brusher or newspaper for providing effective public awareness about the impacts of lead in paint.

The implementation of adequate national regulatory frameworks to govern the manufacture, import, export, sale, and use of lead paints and products coated with lead paints should be supported as a national effort. While determining implementation priorities and timelines, special attention should be paid to the eradication of lead decorative paints and lead paints for other applications that are most likely to cause childhood lead exposure.

Environment, forest and climate change commission must be design and review the current regulatory framework, and consideration should be given to the inclusion of a provision for compliance, monitoring, and enforcement mechanism for the near future.

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APPENDICES

በኢትዮጵያ የአካባቢና የደን ምርምር ኢንስቲትዩት
የሜካላዊ ኢትዮጵያ የአካባቢና የደን ምርምር ማከል



Ethiopian Environment and Forest Research Institute
Ethiopia Environment and Forest Research Center

Sample originator Amir Oumer

Sample type; Paint

Date received at Laboratory 14/03/2021

Report Date 28/06/2021

Lab number	Paint Types	Result in ppm
073/13	Kadisco paint /white for Enamel	14.62
074/13	Zabin wange Paint/light pink for home	617.7
075/13	Rainbow Paint Factory/Green for home	1,145.1
076/13	Kadisco paint/whit for home	18.54
077/13	Zabin wange/ light yellow for house	997.4
078/13	Nefas silk /whit for home	19.26
079/13	Global paint/yellow for home	895.7
080/13	Nefas silk /Red enamel	15.3
081/13	Zabin Wange /Red for home	847.7
082/13	Global paint/ Blue for home	750.6
083/13	Global Paint/ whit for enamel	459.7
084/13	Nefas silk paint /yellow for home	16.4

Comment;

The sample was pre-digested at 40 C⁰ for 20 minutes using HNO₃ to eliminate organic solvents followed by digestion at 120 C⁰ for 3hr using 5 ml HCl and 1ml HF in block digester. The Digested sample was filtered with what man filter paper 41. The filtrates transferred to 100ml volumetric flask and field to the mark with high quality distilled water. The quantification was with 400P analytik jena AAS using both flame and graphite mode as required.

- The result can only be used for research purposes

Analyzed by, ---

ሀብተመሪ ወልደ ወልደ
09/11/2021/09/09 የአካባቢና የደን ምርምር
ማከል/ሀይት አስተባባሪ
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APPENDICES

Annexure 1

Addis Ababa University College of Development Studies Center for Environment & Development Studies

Questionnaires for the key informant interview

Open ended Questionnaire for the key Respondents interview

Dear respondent, the main objectives of this questionnaire is to obtain data on evaluating the management practice in the paint industry in Addis Ababa. The data will be analyzed to examine for potential better improvement of the management practice in the city. The quality of the research work highly depends on your genuine responses. Thank you in advance for your commitment and truthful responses.

I. Gender: Male Female

II. Age(አድራሻ): _____

- 20-30 30-40 40-50

III. Educational background (የትምህርት ደረጃ): _____

- Primary school (የመጀመሪያ ደረጃ) 1-8
- High school graduate (ሁለተኛ ደረጃ የጨረሰ) 9-12
- Undergraduate level (የመጀመሪያ ዲግሪ)
- Masters Level (ሁለተኛ ዲግሪ)

IV. Working position (የስራ ዘርፍ): _____

- የቀለም አምራች ሰራተኛ ነጋዴ የቀን ሰራተኛ የአካባቢ ጥበቃ ተቋም

V. Living area (የመኖሪያ አካባቢ ወይም ክፍለ ከተማ): _____

VI. income (EBT/month)(የወር ደሞዝ) A. 2000-3000 B. 3001-4000 C. 4001-5000 D. 5001-6000 E. >6000

1. General Questions

1.1 What is lead paint? Why is there lead in paint? በቀለሙ ውስጥ ያለው ሊድ ምን ማለት ነው? ሊድ በቀለም ውስጥ ለምን ተገኘ?

2. Management of lead related Questions

2.1 How your factory disposed lead paint? ድርጅታቸው የሊድ ቀለምን እንዴት እያሰገዱ ይገኛሉ?

2.2 What are the new technologies used for lead by products waste management control on your factory? በፋብሪካው ውስጥ የሊድ ተረፈ ምርትን አያያዝ እና አጠባበቅ ተግባራዊ ለማድረግ ምን አይነት ቴክኖሎጂዎች አሉ?

2.3 What do you think the most important and useful issues that lead by products waste and reducing environmental pollution? የሊድ ተረፈ ምርትን እንዲሁም የአካባቢ ብክለትን በመቀነስ ድርጅታቸው ምን አይነት ተግባራትን እያከናወነ ይገኛል?

2.4 Do you think that Technology’s used to control pollution from paint industry? እንዴት ቴክኖሎጂዎች ከቀለም ፋብሪካው የሚወጣውን ብክለት ይቆጣጠራሉ ብለው ያስባሉ?

2.5 What do you know about the best practices of lead management and prevention, internationally to encourage? በአለም አቀፍ ደረጃ የሊድ አያያዝ እንዲሁም መከላከያ ምርጫ ተሞክሮች ምን እንደሆኑ ያውቃሉ?

3. Practice and mechanism related Questions

3.1 What do you know best method for treatment of lead west in paint industry? በቀለም አንዱስትሪዎች ውስጥ ሊድን ለማከም ምን አይነት ዘዴዎቹን ይተገበራሉ?

3.2 What can governments do to address lead paint? (መንግስት የሊድ ቀለምን ለመቅረፍ ምን ማድረግ ያለበት ይመስሉታል?

3.3 How can voluntary efforts eliminate lead paint? እንዴት በፈቃደኝነት ላይ የተመሰረተ የሊድ ቀለምን ማስወገድ ይቻላል?

- 3.4 Do you think is that how many different paints does a manufacturer have to submit for testing? አንድ አምራች ስንት የተለያዩ ቀለሞች ለሙከራ ማቅረብ አለባቸው ብለው ያስባሉ?
- 3.5 How Do you think is that government inspectors testing for compliance with the law have to use third-party laboratories? እንዴት የሕግን ተከባሪነትን ለመፈተሽ የመንግሥት ተቆጣጣሪዎች የሶስተኛ ወገን ላቦራቶሪዎችን መጠቀም አለባቸው ብለው ያስባሉ?
- 2.10 How Do you think about, how does the paint industry using appropriate technological regimes using modern equipment and machinery? እንዴት የቀለም ኢንዱስትሪ ዘመናዊ መሣሪያዎችን እና ማሽነሪዎችን በመጠቀም ተገቢ የቴክኖሎጂ ስርዓቶችን ይጠቀማሉ ብለው ያስባሉ?
- 2.11 What kinds of methods of reducing lead exposure does your factory used? የሊድ ተጋላጭነትን ለመቀነስ ድርጅታቸው ምን አይነት ዘዴዎችን ይጠቀማል?

4. Implementation related Questions

- 4.1 What are the compliance tools in the Model Law? በሞዴል ሕግ ውስጥ የሕግ ተከባሪነት መሣሪያዎች ምንድናቸው?
- 4.2 What is the Model Law and Guidance for Regulating Lead Paint? የሊድ ቀለምን ለመቆጣጠር ሕግ እና መመሪያዎች ምንድን ናቸው?
- 4.3 Why government set a lead limit of 90 ppm in paint instead of requiring paint to be lead-free? ቀለሞች ከሊድ-ነፃ እንዲሆኑ ከመጠየቅ ይልቅ በቀለም ውስጥ የ 90 ፒ.ፒ.ኤም ገደብ ለምን ያዘጋጃሉ?
- 4.4 How do you think that your paint industry company is serious about environmental problems የሚሰሩበት ቀለም ፋብሪካ ወይም ካምፓኒ ለአካባቢያዊ ጉዳዮች ትኩረት ይሰጣል ብለው ያስባሉ እንዴት?

4.5 How do you think that the company conducts environmental monitoring and controls contamination? ኩባንያው የአካባቢ ቁጥጥርን ያካሂዳል እንዲሁም ብክለትን ይቆጣጠራል ብለው ያስባሉ እንዴት?

5. Factors affecting related Questions

5.1 What are the health impacts of lead exposure? ለሊድ መጋለጥ የጤና፣ የአካባቢያዊ እና ኢኮኖሚያዊ ተጽዕኖዎች ምንድናቸው?

5.2 Do Industrial uses of lead paint pose health risks? ኢንዱስትሪዎች ሊድ ያለው ቀለም መጠቀም ለጤና አደገኛ ናቸው ብለው ያስባሉ እንዴት?

5.3 What do you think are the risks associated with exposure to lead and how can the organization prevent its problems? ለሊድ ከመጋለጥ ጋር ምን አይነት አደጋዎች ይፈጠራሉ ብለው ያስባሉ እንዲሁም ድርጅታቹ በምን አይነት ምንገድ ችግሮቹን መከላከል ይችላሉ?

5.4 What is your opinion about the lead in paint industry and its activities? ስለ ቀለም ኢንዱስትሪው እና ስለ ሊድ አጠቃቀም ምን አስተያየት አለዎት?

APPENDICES

Annexure 2

Addis Ababa University College of Development Studies Center for Environment & Development Studies

Identification 1.1. Question no. _____ 1.2. Date of interview _____

Cloth ended Questionnaire for the community

Dear respondent, the main objectives of this questionnaire is to obtain data on identifying, and quantifying the public perception which working in paint industry, distributors and merchant of paint in Addis Ababa. The data will be analyzed to examine for potential better improvement of the public perception about the impacts of lead in paint in the city. The quality of the research work highly depends on your genuine responses. Thank you in advance for your commitment and truthful responses.

Socio-economic and demographic status of employers and distributors in painting industry

General information:

VII. Gender(ጾታ): Male(ወንድ) Female(ሴት)

VIII. Age(አድራሻ): _____

- 20-30 30-40 40-50

IX. Educational background (የትምህርት ደረጃ): _____

- Primary school (የመጀመሪያ ደረጃ) 1-8
 High school graduate (ሁለተኛ ደረጃ የጨረሰ) 9-12
 Undergraduate level (የመጀመሪያ ዲግሪ)
 Masters Level (ሁለተኛ ዲግሪ)

X. Working position (የስራ ዘርፍ): _____

- paint industry workers (የቀለም አምራች ሰራተኛ) merchants (ነጋዴ)
 Day labor (የቀን ሰራተኛ) Environmental protection agency (የአካባቢ ጥበቃ ተቋም)

XI. Living area (የመኖሪያ አካባቢ ወይም ክፍለ ከተማ): _____

XII. Number of children per household (የልጅ ብዛት): _____

XIII. Religion:- Muslim(ሙስሊም) Orthodox(ኦርቶዶክስ) Total(ጠቅላላ)

XIV. income (EBT/month)(የወር ደሞዝ) A. 500-1000 B. 1001-2000 C. 2001-3000 D. 3001-4000 E. >4000

1. Nature of the problem related Questions

1.1 Do you hark before about lead (pb)? (ሊድ ማለት ምን ማለት እንደሆነ ከዚህ በፊት ሰምተው ያውቃሉ?)

- Yes (አዎ) No (የለም)

1.2 Do you hark before about source of the lead (pb)? (የሊድ ምንጭ ምን እንደሆነ ከዚህ በፊት ሰምተው ያውቃሉ?)

- Yes (አዎ) No (የለም)

1.3 Do you think the importance of lead in paint? (በቀለም ውስጥ ያለው ሊድ መጠን ጥቅም አለው በለው ያስባሉ?)

- SD- Strongly Disagree (በጣም አልስማማም), D- Disagree (አልስማማም), N- Neutral (ገለልተኛ), A- Agree (እስማማለሁ), SA- Strongly Agree (በጣም እስማማለሁ)

1.4 Does your children usually play with toys and related materials? (ልጆችዎ ብዙውን ጊዜ በአሻንጉሊት እና ተመሳሳይ ቁሳቁሶችን ይጫወታሉ?)

- Yes (አዎ) No (የለም)

2. Cause and effects of lead related Questions(የሊድ መንጮችና ውጤቶች ጋር የተያያዙ ጥያቄዎች)

2.1 Do you hark before the impacts of lead in paint on health and environment? (ከዚህ በፊት በቀለም ውስጥ ያለው ሊድ በጤና እና በአካባቢ ላይ የሚያደርሰውን ጉዳት ሰምተው ያውቃሉ?)

- Yes (አዎ) No (የለም)

2.2 Do you checked the labeled brand of paint where the lead level are applied or not during purchased it)? (በማንኛውም የቀለም ምርት ላይ የሊድ መጠን መኖሩን ወይም አለመኖሩን የሚያሳይ ምልክት አረጋግጠው ገዝተው ያውቃሉ?)

- yes always checked (አዎ ሁሌም አረጋግጣለሁኝ?) No (አረጋግጬ አላውቅም?)

2.3 Do you use the safety equipment like facemask, hand glove when you are doing paint smear for your home? (እቤትዎን በሚቀበቡበት ጊዜ ለጥንቃቄ የሚረዱ ቁሳቁሶችን ማለትም እንደ የአፍና የአፍንጫ ማስክ እንዲሁም የእጅ ጉአንት ተጠቅሞው ያውቃሉ?)

- Yes (አዎ) No (የለም)

2.4 Has your child's blood been tested for lead within the last 12 months (ልጅዎን በ 12 ወራት ጊዜ ውስጥ የሊድ መጠንን ለማወቅ አስመርምረው ያውቃሉ?)

- Yes (አዎ) No (የለም)

2.5 Does your child live with an adult or have contact with an adult who works with lead (ልጅዎ በቀጥተኛ ወይም በተዘዋዋሪ ከሊድ ጋር ግንኙነት ካለው ሰው ጋር ነው የሚኖረው?)

- Yes (አዎ) No (የለም)

2.6 Does your kids had under the age of six? (ልጆችዎ ከ6 አመት በታች የአድሜ ክልል ውስጥ ነው የሚገኙት)

- Yes (አዎ) No (የለም)

If ‘‘yes’’ to the above question, have you ever seen your children usually put paint chips or soil in their mouth (ከላይ ለተጠቀሰው ጥያቄ መልሶ አዎ ከሆነ ልጆችዎ በተለምዶ የግርግዳ ፍቅፋቂ ቀለም ወይም አፈር ወደ አፋቸው ሲያደረጉ አይተው ያውቃሉ?)

- Yes (አዎ) No (የለም)

2.7 Do your think that does your kid have bad behaviors (ልጆችዎ በባህሪያቸው አስቸጋሪ ጸባይ አላቸው በለው ያስባሉ?)

- SD- Strongly Disagree (በጣም አልስማማም), D- Disagree (አልስማማም), N- Neutral (ገለልተኛ),

- A- Agree (እስማማለሁ), SA- Strongly Agree (በጣም እስማማለሁ)

2.8 Do you think it is important to check children’s blood lead and lead excretion? (ልጆችዎን በደም ውስጥ ያለው ሊድ መመርመር አስፈላጊ ነው ብለው ያስባሉ?)

- SD- Strongly Disagree (በጣም አልስማማም), D- Disagree (አልስማማም), N- Neutral (ገለልተኛ),

- A- Agree (እስማማለሁ), SA- Strongly Agree (በጣም እስማማለሁ)

2.9 Have you ever been trained or educated by minister of Health or environmental protection office about countermeasures against the impacts of lead accidents? (ሊድ የሚያስከትላቸውን አደጋዎች እና ተጽዕኖዎች እንዲሁም ስለ መከላከያ እርምጃዎች ከጤና ጥበቃ ወይም ከአካባቢ ጥበቃ መ/ቤቶች ስልጠና ተሰጥቶታል? ያውቃሉ?)

- Yes (አዎ) No (የለም)

2.10 Do you think that paint Industry Company is serious about environmental and health problems (የቀለም ፋብሪካዎች ወይም ካምፓኒ ለአካባቢያዊ እና ለጤና ችግሮች ወይም ጉዳዮች ትኩረት የሚሰጡ ይመስሎታል?)

- SD- Strongly Disagree (በጣም አልስማማም), D- Disagree (አልስማማም), N- Neutral (ገለልተኛ), A- Agree (እስማማለሁ), SA- Strongly Agree (በጣም እስማማለሁ)

2.11 Do you think the governmental authority has taken proper action against the impacts of related lead accidents in the past? (መንግሥት ቀደም ሲል የሊድ ንጥረ ነገሮችን እንዲሁም ተያያዥ አደጋዎች ላይ ተገቢውን እርምጃ የወሰደ ይመስሎታል?)

- SD- Strongly Disagree (በጣም አልስማማም), D- Disagree (አልስማማም), N- Neutral (ገለልተኛ), A- Agree (እስማማለሁ), SA- Strongly Agree (በጣም እስማማለሁ)

2.12 Do you think about, paint industry using appropriate technological regimes using modern equipment and machinery? (የቀለም ኢንዱስትሪ ዘመናዊ መሣሪያዎችን እና ማሽነሪዎችን በመጠቀም ተገቢ የቴክኖሎጂ ስርዓቶችን ተከትለው የሚሰሩ ይመስሎታል?)

- SD- Strongly Disagree (በጣም አልስማማም), D- Disagree (አልስማማም), N- Neutral (ገለልተኛ), A- Agree (እስማማለሁ), SA- Strongly Agree (በጣም እስማማለሁ)

3. Legal Related Questions(ከህግ ጋር ተያያዥ የሆኑ ጥያቄዎች)

3.1 Do you know the regulation to control lead in paint? (በቀለም ውስጥ ያለውን የሊድ መጠን የሚቆጣጠር አዋጃ እንዳለ ያውቃሉ?)

- Yes (አዎ) No (የለም)

3.2 Do you know about the compliance office to control lead in paint in Addis Ababa? (በቀለም ውስጥ ያለውን የሊድ መጠን የሚቆጣጠር የህግ ተከባሪነት ቢሮ እንዳለ ያውቃሉ?)

- Yes (አዎ) No (የለም)

3.3 Did you know that the government has banned the use of lead in paint in excess of 90 ppm? (መንግስት በቀለም ውስጥ ያለውን የሊድ መጠን 90 ፒፒኤም ገደብ በላይ መጠቀም የተከለከለ እንደሆነ ያውቃሉ?)

- Yes (አዎ) No (የለም)

3.4 Did you know that the Proclamation requires that any paint manufacturer be required to post lead-free paint on paints? ማንኛውም የቀለም አምራች ፋብሪካ በቀለም ምርቶች ላይ ከሊድ ነጻ ወይም ይህን ያህል የሊድ መጠን በቀለሙ ምርት ላይ መለጠፍ እንዳለበት አዋጁ እንደሚያስገድድ ያውቃሉ?

- Yes (አዎ) No (የለም)

3.5 Have you ever paid extra for a lead-free paint product (ከሊድ ነጻ ለሆነ የቀለም ምርት ተጨማሪ ክፍያ ከፍለው ያውቃሉ?)

- Yes (አዎ) No (የለም)

APPENDICES

Annexure 3

Addis Ababa University College of Development Studies Center for Environment & Development Studies

Checklist for Feld Observation and key informant interview to evaluate the management Practice of Lead in paint in Addis Ababa (2021)

Requested by: Amir Oumer

Phone 0911433824

Email- oumer.amir900@gmail.com

Name of the Organization _____

Date of Observation _____

Time Of observations _____

No	Issues to be Observed	Responses from interview and field observation	Remarks
1	Is there any regulations under the organization to manage lead in paint?		
2	Does the industry have treatment plant for disposal of lead by products?		
3	What kinds of technology did they used during their production/process?		
4.	What are the existing management practices undertaking by the organizations?		
5.	What are the management plan or strategies set by the organization to reduce lead in paint release?		
6.	Does the industry have annual report on Waste Minimization and Pollution Prevention Plan regarding on lead by products?		
7.	Does the facility conduct appropriate Waste Determinations? Lists of wastes produced <ul style="list-style-type: none">• Process descriptions• Material Safety Data Sheets• Waste Profile Sheets• Sampling plans• Analytical results		

8.	Has the facility storing and managed hazardous waste complied with Proc.1090/2010 to Pollution prevention to reduce contaminants? Note: Documents must show Labelling		
9.	Does the industry labelling the amount of lead in paint brands?		
10.	Are all hazardous waste storage containers marked with the words "Hazardous Waste"?		
11.	Are all hazardous waste storage containers in good condition?		
12.	Are all hazardous waste like byproducts of lead accumulation containers closed/sealed?		
13.	Does the industry monitor the status of environmental pollution for lead released?		
14.	Does the industry have records for each hazardous waste generated?		
15.	Does the facility maintain hazardous waste management personnel training documents and records at the facility?		
16.	Does the industry maintain Personal protective Equipment for hazardous waste management like lead (pb)?		
17.	Does the industry used expired lead as in put for making paint?		
18.	Does the facility have a Pollution Prevention Plan on file?		