ETHIOPIA

LEAD IN SOLVENT-BASED PAINTS FOR HOME USE IN ETHIOPIA

June 2017

Pesticide Action Nexus Association

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NATIONAL REPORT

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ACKNOWLEDGMENTS

We take this opportunity to thank all those who were instrumental in compiling and shaping this paint study.

The analytical study providing data to this report was undertaken as part of the Lead Paint Elimination Project in Africa, funded by the Global Environment Facility (GEF), implemented by UN Environment and executed by IPEN. The Lead Paint Elimination Project in Africa was established to eliminate lead in paint and raise widespread awareness among business entrepreneurs and consumers about the adverse human health impacts of lead-based household enamel paints, particularly on the health of children under six years old. The study was conducted in Ethiopia by Pesticide Action Nexus Association (PAN-Ethiopia) in partnership with IPEN.

This report was developed by PAN-Ethiopia and IPEN as part of IPEN's Global Lead Paint Elimination Campaign.

While this study was undertaken with the assistance of the Global Environment Facility and UN Environment, responsibility for the content lies entirely with IPEN and PAN-Ethiopia. The GEF and UN Environment do not necessarily share the expressed views and interpretations.

Established in 1998, IPEN is currently comprised of over 500 Participating Organizations in 116 countries, primarily developing and transition countries. IPEN brings together leading environmental and public health groups around the world to establish and implement safe chemicals policies and practices that protect human health and the environment. IPEN's mission is a toxics-free future for all.

IPEN
a toxics-free future

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CONTENTS

PREFACE

Lead paints for home use continue to be widely produced, sold, and used in developing countries despite the fact that most highly industrial countries banned lead paints for household use more than 40 years ago. IPEN and Participating Organizations are part of the global movement to eliminate lead paint by 2020 to protect children's health.

In 2007 and 2008, NGOs in the IPEN network collected and analyzed decorative (home use) paints on the market in 11 developing countries, and in countries with economies in transition. The results were startling. In every one of these countries, many of the paints contained dangerously high lead levels. In response, IPEN launched its Global Lead Paint Elimination Campaign, which seeks to eliminate lead in paint and raise widespread awareness among business entrepreneurs and consumers about the adverse human health impacts of lead paint, particularly on the health of children. Since then, IPEN-affiliated NGOs and others have sampled and analyzed paints on the market in approximately 50 low- and middle-income countries.

This report presents new data on the total lead content of solvent-based paints for home use available on the market in Ethiopia. It also presents background information on why the use of lead paint is a source of serious concern, especially to children's health; a review of national policy frameworks that are in place to ban or restrict the manufacture, import, export, distribution, sale and use of lead paint, and provides a strong justification to adopt and enforce further regulatory controls in Ethiopia. Finally, it proposes action steps by different stakeholders to protect children and others from lead paint.

This study was conducted by Pesticide Action Nexus Association (PAN-Ethiopia) in partnership with IPEN.

IPEN is an international NGO network of health and environmental organizations from all regions of the world of which PAN-Ethiopia is a member. IPEN is a leading global organization working to establish and implement safe chemicals policies and practices to protect human health and the environment. Its mission is a toxics-free future for all. IPEN helps build the capacity of its member organizations to implement on-the-ground activities, learn from each other's work, and work at the international level to set priorities and achieve new policies.

Pesticide Action Nexus Association (PAN-Ethiopia) works on environment and development issues to contribute to the eradication of poverty in Ethiopia and beyond through raising awareness among the public in order to prevent the negative public health and environmental impacts of pesticides and other hazardous chemicals. Its main purpose is to support policies and strategies that enhance and promote the implementation of a safe and sustainable environment for all people and other living things, keeping them protected from harm posed by hazardous chemicals by building close collaboration among government and non-governmental organizations, civil society interest groups, urban and rural communities, nationally and internationally. PAN-Ethiopia coordinates the IPEN global E-products working group.

EXECUTIVE SUMMARY

Lead is a toxic metal that causes adverse effects on both human health and the environment. While lead exposure is also harmful to adults, lead exposure harms children at much lower levels, and the health effects are generally irreversible and can have a lifelong impact.

The younger the child, the more harmful lead can be, and children with nutritional deficiencies absorb ingested lead at an increased rate. The human fetus is the most vulnerable, and a pregnant woman can transfer lead that has accumulated in her body to her developing child. Lead is also transferred through breast milk when lead is present in a nursing mother.

Evidence of reduced intelligence caused by childhood exposure to lead has led the World Health Organization (WHO) to list "lead-caused mental retardation" as a recognized disease. WHO also lists it as one of the top ten diseases whose health burden among children is due to modifiable environmental factors.

Lead paint is a major source of childhood lead exposure. The term lead paint is used in this report to describe any paint to which one or more lead compounds have been added. The cut-off concentration for lead paint used in the report is 90 parts per million (ppm, dry weight of paint), the strictest legal limit enacted in the world today. All lead concentrations in the report are total lead levels, unless otherwise specified.

Most highly industrial countries adopted laws or regulations to control the lead content of decorative paints—the paints used on the interiors and exteriors of homes, schools, and other child-occupied facilities—beginning in the 1970s and 1980s. In Ethiopia, there is currently no regulation in place limiting the amount of lead in paint for household and decorative use.

From June 2016 to January 2017, PAN-Ethiopia purchased a total of 36 cans of solvent-based paint intended for home use from stores in Addis Ababa, Ethiopia. The paints represented 11 different brands produced by 11 manufacturers, including one brand manufactured by an Indian company. All paints were analyzed by an accredited laboratory in the United States of America for their lead content, based on dry weight of the paint. The laboratory participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program operated by the American Industrial Hygiene Association (AIHA), assuring the reliability of the analytical results.

RESULTS

27 out of 36 analyzed solvent-based paints for home use (75 percent of paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm, dry weight of paint). This is also the regulatory limit for lead in decorative paint in e.g., India, the Philippines, and the United States of America. Moreover, 15 paints (42 percent of paints) contained dangerously high lead concentrations above 10,000 ppm. The highest lead concentration detected was 100,000 ppm in two orange paints sold for home use—Abay Paints and Dil Paints, both of which were manufactured in Ethiopia.

On the other hand, 9 out of 36 solvent-based paints for home use (25 percent of paints) contained lead concentrations below 90 ppm, suggesting that the technology to produce paint without lead ingredients exists in Ethiopia. The lowest lead concentration detected was less than 60 ppm from 7 paints (19 percent of paints) from 4 paint brands (36 percent of paint brands).

10 out of 11 analyzed brands (91 percent of paint brands) sold at least one lead paint, i.e., a paint with lead concentration above 90 ppm. 9 out of 11 analyzed brands (82 percent of paint brands) sold at least one lead paint with dangerously high lead concentrations above 10,000 ppm. On the other hand, all three paints from the Indian brand, Unitint Universal Stainer, contained lead concentrations less than 60 ppm.

Yellow and orange paints most frequently contained dangerously high lead concentrations above 10, 0000 ppm. Of 11 yellow paints, 9 (82 percent of yellow paints) contained lead levels above 10, 000 ppm; of 7 orange paints, 5 (71 percent of orange paints) contained lead levels above 10, 000 ppm; and of 9 red paints, 1 (11 percent of red paints) contained lead levels above 10, 000 ppm. All 9 white paints contained lead levels below 10, 000 ppm.

In general, paint can labels did not carry meaningful information about lead content or the hazards of lead paint. None of the paints provided information about lead on their labels and most paints carried little information about any ingredients on can labels. Most paints were merely labeled as “enamel” or “synthetic enamel,” with no further details on the type of solvents and pigments (organic or inorganic) provided on paint can labels. Manufacturing dates or batch numbers were included on the labels of 3 out of 36 paints (8 percent of paints) included in this study. All three paints with manufacturing dates were imported from India, while the remaining 33 paints without manufacturing dates were manufactured in Ethiopia. Most warning symbols on the paint cans indicated the flammability of the paints, but no precautionary warnings on the effects of lead dust to children and pregnant women were provided.

Lead levels in this study are consistent with the results of a similar paint study conducted by PAN-Ethiopia in 2015. In that study, 36 solvent-based paints from 9 brands were purchased and analyzed. In the previous study, 28 of 36 paints (78 percent of paints) contained lead levels above 90 ppm, and 17 of 36 paints (47 percent of paints) contained lead levels above 10,000 ppm. The highest lead concentration detected in the 2015 study was 110,00 ppm from an orange Abay Paints. Similarly, an orange Abay Paints is one of two paints which contained the highest lead level at 100,000 ppm in the current study.

Only 2 out of 25 paints analyzed in 2015 showed a significant decrease on its lead content in the current study. The reduction in lead content was observed in two Kokeb Paints: a white paint with 4,900 ppm in 2015 to less than 80 ppm in 2017, and a red paint with 4,300 ppm in 2015 to less than 70 ppm in 2017.

CONCLUSIONS

This study demonstrates that solvent-based paints for home use with high concentrations of lead are widely available in Ethiopia since the paints included in this study are brands commonly sold in retail stores all over Ethiopia. However, the fact that 9 out of 36 paints (25 percent of paints) contained lead concentrations below 90 ppm indicates that the technology to produce paints without added lead exists in Ethiopia. The study results provide a strong justification to adopt and enforce a regulation that will ban the manufacture, import, export, distribution, sale and use of paints with total lead concentrations greater than 90 ppm.

RECOMMENDATIONS

To address the problem of lead in paint, PAN-Ethiopia and IPEN propose the following recommendations:

Government and Government Agencies

The Ethiopian Ministry of Environment Forest and Climate Change should finalize amending the draft regulation, which upon implementation, will ban the manufacture, import, export, distribution, sale and use of paints that contain total lead concentrations exceeding 90 ppm, the most restrictive standard in the world. They should also require paint companies to display sufficient information indicating harmful content on paint can labels such as solvents and provide a warning on possible lead dust hazards when disturbing painted surfaces.

Paint Industry

Paint companies that still produce lead- paints should expeditiously stop the use of leaded paint ingredients in paint formulations. Paint companies that have shifted to non-lead paint production should get their products certified through independent, third party verification procedures to increase the customer's ability to choose paints with no added lead.

Individual, Household and Institutional Consumers

Paint consumers should demand paints with no added lead from paint manufacturers and retailers, as well as full disclosure of a paint product's content. Household and institutional consumers should ask for, consciously buy, and apply only paints with no added lead in places frequently used by children such as homes, schools, day care centers, parks and playgrounds.

Organizations and Professional Groups

Public health groups, consumer organizations and other concerned entities should support the elimination of lead paint, and conduct activities to inform and protect children from lead exposure through lead paint, lead in dust and soil, and other sources of lead.

All Stakeholders

All stakeholders should come together and unite in promoting a strong policy that will eliminate lead paint in Ethiopia.

1. BACKGROUND

1.1 HEALTH AND ECONOMIC IMPACTS OF LEAD EXPOSURE

Children are exposed to lead from paint when lead-containing paint on walls, windows, doors or other painted surfaces begins to chip or deteriorate, since this causes lead to be released to dust and soil. When a surface previously painted with lead paint is sanded or scraped in preparation for repainting, very large amounts of lead-contaminated dust is produced, which, when spread, can constitute a severe health hazard.[1]

Children playing indoors or outdoors get house dust or soil on their hands, and then ingest it through normal hand-to-mouth behavior. If the dust or the soil is contaminated with lead, the children will ingest lead. Hand-to-mouth behavior is especially prevalent in children aged six years and under, the age group most easily harmed by exposure to lead. A typical one- to six-year-old child ingests between 100 and 400 milligrams of house dust and soil each day.[2]

In some cases, children pick up paint chips and put them directly into their mouths. This can be especially harmful because the lead content of paint chips is typically much higher than what is found in dust and soils. When toys, household furniture, or other articles are painted with lead paint, children may directly ingest the lead-contaminated, dried paint when chewing on them. Nonetheless, the most common way that children ingest lead is through lead-contaminated dust and soil that gets onto their hands.[3]

While lead exposure is also harmful to adults, lead exposure harms children at much lower levels. In addition, children absorb up to five times as much of ingested lead than adults. Children with nutritional deficiencies absorb ingested lead at an even increased rates.[2]

The younger the child, the more harmful lead can be and the health effects are generally irreversible and can have a lifelong impact. The human fetus is the most vulnerable, and a pregnant woman can transfer lead that has accumulated in her body to her developing child.[4] Lead is also transferred through breast milk when lead is present in a nursing mother.[5]

Once lead enters a child's body through ingestion, inhalation, or across the placenta, it has the potential to damage a number of biological systems and pathways. The primary target is the central nervous system and the brain, but

Lead Paint Terminology

As used in this booklet:

- "Paint" includes varnishes, lacquers, stains, enamels, glazes, primers, or coatings used for any purpose. Paint is typically a mixture of resins, pigments, fillers, solvents, and other additives.
- "Lead paint" is paint to which one or more lead compounds have been added.
- "Lead pigments" are lead compounds used to give a paint product its color.
- "Lead anti-corrosive agents" are lead compounds used to protect a metal surface from rusting or other forms of corrosion.
- "Lead driers" are lead compounds used to make paint dry more quickly and evenly.
- "Decorative paint" refers to paints that are produced for use on inside or outside walls, and surfaces of homes, schools, commercial buildings, and similar structures. Decorative paints are frequently used on doors, gates, and windows, and to repaint household furniture such as cribs, playpens, tables, and chairs.
- "Solvent-based, enamel decorative paint" or "enamel decorative paint" refers to oil-based paints.
- "ppm" means parts per million total lead content by weight in a dried paint sample. All lead concentrations in the report are total lead levels, unless otherwise specified.

lead can also affect the blood system, the kidneys, and the skeleton.[6] Lead is also categorized as an endocrine-disrupting chemical (EDC).[7]

It is generally agreed that one key element in lead toxicity is its capacity to replace calcium in neurotransmitter systems, proteins, and bone structure, altering function and structure and thereby leading to severe health impacts. Lead is also known to affect and damage cell structure.[8]

According to the World Health Organization (WHO): "Lead has no essential role in the human body, and lead poisoning accounts for about 0.6 percent of the global burden of disease."[2] Evidence of reduced intelligence caused by childhood exposure to lead has led WHO to list "lead-caused mental retardation" as a recognized disease. WHO also lists it as one of the top ten diseases whose health burden among children is due to modifiable environmental factors.[9]

In recent years, medical researchers have been documenting significant health impacts in children from lower and lower levels of lead exposure.[2, 6] According to the factsheet on Lead Poisoning and Health from WHO: "There is no known level of lead exposure that is considered safe."[10]

When a young child is exposed to lead, the harm to her or his nervous system makes it more likely that the child will have difficulties in school and engage in impulsive and violent behavior.[11] Lead exposure in young children is also linked to increased rates of hyperactivity, inattentiveness, failure to graduate from high school, conduct disorder, juvenile delinquency, drug use, and incarceration.[2] Lead exposure impacts on children continue throughout life and have a long-term impact on a child's work performance, and—on average—are related to decreased economic success.

A recent study investigating the economic impact of childhood lead exposure on national economies in all low- and middle-income countries estimated a total cumulative cost burden of $977 billion international dollars* per year.[12] The study considered the neurodevelopmental effects on lead-exposed children, as measured by reduced IQ points, and it correlated lead exposure-related reductions in children's IQ scores to reductions in lifetime economic productivity, as expressed in lifelong earning power. The study identified many different sources of lead exposure in children, with lead paint as one major source. Broken down by region, the economic burden of childhood lead exposure as estimated by this study was:

Africa: Intl$134.7 billion of economic loss, or 4.03 percent of Gross Domestic Product (GDP);

Latin America and the Caribbean: Intl$142.3 billion of economic loss, or 2.04 percent of GDP; and

Asia: Intl$699.9 billion of economic loss, or 1.88 percent of GDP.

Country estimates used in this study can be accessed at a publically available website, **http://www.med.nyu.edu/pediatrics/research/environmentalpediatrics/leadexposure**, and shows that ***economic loss in Ethiopia is estimated at Intl$4.47 billion, or 4.73 percent of Gross Domestic Product (GDP).***

* An International dollar is a currency unit used by economists and international organizations to compare the values of different currencies. It adjusts the value of the U.S. dollar to reflect currency exchange rates, purchasing power parity (PPP), and average commodity prices within each country. According to the World Bank, "An international dollar has the same purchasing power over GDP as the U.S. dollar has in the United States." The international dollar values in this report were calculated from a World Bank table that lists GDP per capita by country based on purchasing power parity and expressed in international dollars.

1.2 THE USE OF LEAD IN PAINT

Paints contain high levels of lead when the paint manufacturer intentionally adds one or more leaded compounds to the paint for some purpose. 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 intentionally used in solvent-based paint due to their chemical properties, and solvent-based paints have been found to have high lead content in many countries.[13-15]

The leaded compounds most commonly added to paints are pigments. Pigments are used to give the paint its color, make the paint opaque (so it covers well), and protect the paint and the underlying surface from degradation caused by exposure to sunlight. Lead-based pigments are sometimes used alone, and sometimes used in combination with other pigments.

Leaded compounds also may be added to enamel paints for use as driers (sometimes called drying agents or drying catalysts). Leaded compounds are also sometimes added to paints used on metal surfaces to inhibit rust or corrosion. The most common of these is lead tetroxide, sometimes called red lead or minium.

Non-leaded pigments, driers, and anti-corrosive agents have been widely available for decades, and are used by manufacturers producing the highest quality paints. When a paint manufacturer does not intentionally add lead compounds in the formulation of its paints, and takes care to avoid the use of paint ingredients that are contaminated with lead, the lead content of the paint will be very low—less than 90 parts per million (ppm) lead by dry weight, and frequently down to 10 ppm or less.

Most highly industrial countries adopted laws or regulations to control the lead content of decorative paints beginning in the 1970s and 1980s. Many also imposed controls on the lead content of paints used on toys and for other applications likely to contribute to lead exposure in children. These regulatory actions were taken based on scientific and medical findings that lead paint is a major source of lead exposure in children, and that lead exposure in children causes serious harm, especially to children aged six years and under.

The use of lead in production of decorative paint is prohibited in the European Union through regulations related to safety of consumer products and specific prohibitions for most leaded raw materials. In the U.S., Canada, Australia and other countries with regulations restricting the use of leaded ingredients in decorative paint, standards specifying a maximum lead limit are in place. The

current standard for household paints in e.g., the U.S., the Philippines, and India is a total maximum lead content of 90 ppm lead, and adherence to this ensures that a manufacturer can sell its paint anywhere in the world. Some other countries such as Brazil, South Africa, and Sri Lanka have established standards of 600 ppm total lead.

1.3 PAINT MARKET AND REGULATORY FRAMEWORK IN ETHIOPIA

The Ethiopian Paints Factory supplies their products only to the local market. However, preparations are underway to study the market segment and the paint products in the neighboring Eastern African countries. Studies indicate that paint factories didn't operate at full capacity due to various reasons. However, the paint market demand is increasing from time to time primarily because of the booming construction industry in the country.

Even though an expanded sector-wise market share studies was not done, Nefas Silk Paint Factory's five-year strategic plan from 2006 to 2010 projected its market share to be around 30 to 40 percent (Gizaw, 2006).[17] Currently, it has an attainable production capacity of 32 million liters of paints per annum and produces more than 1,500 types of paints and paint-related products.[18]

Asian Paints, India's leading paint manufacturer, acquired 51 percent stake in the Ethiopia-based Kadisco Paint and Adhesive Industry Share Company (Kadisco) for $18.95 million since 2014. Kadisco has an annual production capacity of 30 million liters of paints.[19]

Zemilli Paints Factory, manufacturer of Mega Paints and part of DH Geda PLC, has an estimated annual production of 9 million liters of paints.[20]

Ethiopia does not have existing regulatory framework that limits the concentration of lead in household decorative paints. Initial data on the lead content in paints were released through an Ethiopian study initiated by IPEN in 2012/2013. A second study on lead paints in Ethiopia was undertaken through the UNEP-GEF African Lead Paint Elimination Project (ALPEP) which started in 2014/2015. Under the ALPEP, dialogues about the importance of national regulatory framework to limit lead in paint were initiated, paving the way for the Ethiopian standards agency to formulate a voluntary standard of 90-ppm total lead limit in paints in Ethiopia. The standards agency also requested the Ministry of Environment, Forest and Climate Change to formulate a mandatory regulation to enforce it legally. The Ministry of Environment, Forest and Climate Change now drafted a national regulation which sets 90 ppm total lead as limit in Ethiopian paints and in items that use leaded paints as an input. The draft regulation is set under the Environmental Pollution Control Proclamation

Number 300/2002.[21] The draft regulation passed through different review processes and is expected to be presented to the Council of Ministers of Ethiopia for ratification in 2017 as an enforceable national regulation.

2. MATERIALS AND METHODS

From June 2016 to January 2017, 36 cans of solvent-based paint intended for home use were purchased by PAN-Ethiopia from various stores in Addis Ababa, Ethiopia. The paints represented 11 different brands produced by 11 manufacturers.

In most cases, one white paint and one or more bright-colored paints such as red, orange or yellow were selected. Additionally, 3 tinting stainers for consumer use were also included in this study. The availability of these paints in retail establishments suggested that they were intended to be used within home environments. Excluded were automotive and industrial paints that are not typically used for domestic housing applications.

During the paint sample preparation, information such as color, brand, manufacturer, country where manufactured, product codes, production dates, and other details as provided on the label of the paint can were recorded. Generic paint colors were recorded, e.g., "yellow" instead of "sunflower." For all colored paints, the protocol called for obtaining "bright" or "strong" red and yellow paints when available.

Paint sampling preparation kits containing individually numbered, untreated wood pieces, single-use paintbrushes and stirring utensils made from untreated wood sticks were assembled and shipped to PAN-Ethiopia by the staff of the IPEN partner NGO, Arnika, in The Czech Republic.

Each can of paint was thoroughly stirred and was subsequently applied onto individually numbered triplicates of untreated, labelled wood pieces using different unused, single-use paintbrushes by a researcher of PAN-Ethiopia as shown in Figure 1.

Each stirring utensil and paintbrush was used only for the same paint, and extra caution was taken to avoid cross contamination. All samples were then allowed to dry at room temperature for five to six days. After drying, the painted wood pieces were placed in individually labelled, resealable plastic bags and shipped for analysis of lead content to Forensic Analytical Laboratories, Inc. in the United States of America. The laboratory participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) Program operated by the American Industrial Hygiene Association. In the laboratory selection process, IPEN further assessed the reliability of the laboratory results by conducting

Figure 3. Paints included in the study.

an independent quality assurance testing. This was made by sending paint samples with a known lead content to the laboratory, and evaluating the results received.

The laboratory's lower limit of detection for the lead concentration in the paint samples is dependent on the amount of paint in the samples. Generally, the lowest detection limit for the method used is 60 ppm, but if only a small amount of paint is available, the detection limit increases.

The paint samples were analyzed using method EPA3050B/7000B, i.e., through acid digestion of the samples, followed by Flame Atomic Absorption Spectrometry, as recognized by the WHO as appropriate for the purpose.[16]

3. RESULTS

3.1 SUMMARY OF RESULTS

This study shows that:

- 27 out of 36 analyzed solvent-based paints (75percent of paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm), dry weight. In addition, 15 paints (42 percent of paints) contained dangerously high lead concentrations above 10,000 ppm.
- 10 out of 11 analyzed brands (91 percent of paint brands) sold at least one lead paint, i.e., a paint with lead concentration above 90 ppm. Also, 9 out of 11 analyzed brands (82 percent of paint brands) sold at least one lead paint with dangerously high lead concentrations above 10,000 ppm.
- 22 out of 27 bright-colored paints (81 percent of bright-colored paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm), dry weight. Yellow and orange paints were the most hazardous with 9 out of 11 yellow paints (82 percent of yellow paints) and 5 out of 7 orange paints (71 percent of orange paints) containing lead concentrations greater than 10,000 ppm; 1 out of 9 red paints (11 percent of red paints) also contained dangerously high lead concentrations above 10,000 ppm.
- The highest lead concentration detected was 100,000 ppm in two orange paints from Abay Paints and Dil Paints sold for home use.
- None of the paints provided information about lead on their labels and most paints carried little information about ingredients. Most paints were merely labeled as "enamel" or "synthetic enamel," with no further details on the type of solvents and pigments (organic or inorganic) provided. Most warning symbols on the paint cans indicated the flammability of the paints, but no precautionary warnings on the effects of lead dust to children and pregnant women were provided.

3.2 LEAD CONTENT ANALYSIS

27 out of 36 analyzed solvent-based paints (75 percent of paints) were lead paints, i.e., contained a lead concentration above 90 ppm — 15 of these contained dangerously high lead concentrations above 10,000 ppm (42 percent of paints).

Two orange paints from Abay Paints and Dil Paints contained the highest concentration of lead at 100,000 ppm, while the lowest concentration of lead less than 60 ppm was detected in 7 paints from the following brands: Addis Synthetic Paint (white), Bright Paints (white), Tsehay Paints (red and white), and Unitint Universal Stainer (orange, red and yellow).

The ten solvent-based paints with the highest amounts of lead are summarized in Table 1.

TABLE 1. TOP 10 SOLVENT-BASED PAINTS WITH THE HIGHEST LEAD CONTENT.

Rank	Sample No.	Brand	Manufacturer	Country of Manufacture	Color	Lead Content (ppm)
1	ETH-83	Abay Paints	Abay Paint Factory	orange	100,000	84,000
2	ETH-79	Dil Paints	Modern Paint Industry	orange	100,000	84,000
3	ETH-71	Kokeb Paints	Nefas Silk Paint Factory	yellow	98,000	61,000
4	ETH-72	Kokeb Paints	Nefas Silk Paint Factory	orange	74,000	57,000
5	ETH-94	Kadisco Paints	Kadisco Industry Group	yellow	73,000	28,000
6	ETH-78	Dil Paints	Modern Paint Industry	yellow	72,000	24,000
7	ETH-82	Abay Paints	Abay Paint Factory	yellow	70,000	21,000
8	ETH-90	Addis Synthetic Paint	Addis Paint Product	yellow	60,000	17,000
9	ETH-95	Kadisco Paints	Kadisco Industry Group	red	55,000	15,000
10	ETH-67	Mega Paints	Zemilli Paint Factory	yellow	40,000	11,000

3.3 PAINT BRAND ANALYSIS

9 out of 11 analyzed brands (82 percent of paint brands) sold at least one paint with dangerously high lead concentration above 10,000 ppm.

Among solvent-based decorative paints, two orange paints from Abay Paints and Dil Paints contained the highest concentration of lead at 100,000 ppm. On the other hand, at least one paint from each of the following brands contained lead below 90 ppm: Addis Synthetic Paint (white); Bright Paints (white);

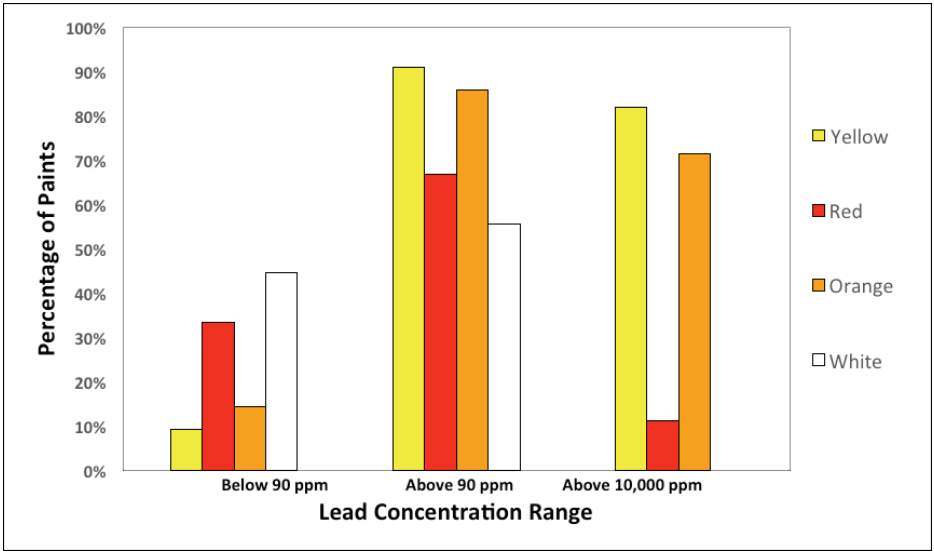

Figure 2. Paints included in the study.

Kokeb Paints (red and white), Tsehay Paints (red and white); and Unitint Universal Stainer (orange, red and yellow). This indicates that the technology to produce paints without added lead exists in Ethiopia.

3.4 PAINT COLOR ANALYSIS

22 out of 27 bright-colored paints (81 percent of bright-colored paints) such as yellow, orange and red contained lead concentrations above 90 ppm, 15 paints of which contained dangerously high lead concentrations above 10,000 ppm (56 percent of bright-colored paints).

This study included 11 yellow paints, 9 red paints, 9 white paints, and 7 orange paints. Yellow, orange and red paints contained the highest lead concentrations.

Among bright-colored paints, 10 out of 11 yellow paints (91 percent of yellow paints) contained lead concentrations above 90 ppm, 9 paints of which exceeded more than 10,000 ppm of lead (82 percent of yellow paints); 6 out of 7 orange paints (86 percent of orange paints) contained lead concentrations above 90 ppm, 5 paints of which exceeded more than 10,000 ppm of lead (71 percent of orange paints); and 6 out of 9 red paints (67 percent of red paints) contained lead concentrations above 90 ppm, 1 paint of which exceeded more than 10,000 ppm of lead (11 percent of red paints).

The distribution of lead concentrations in different colors is shown in Figure 2.

3.5 LABELING

In general, most paint can labels did not carry meaningful information about lead content or the hazards of lead paint.

None of the paints provided information about lead on their labels and most paint can labels carried little information about any ingredients. Most paints were merely labeled as "enamel" or "synthetic enamel," with no further details on the type of solvents and pigments (organic or inorganic) provided on paint can labels. Manufacturing dates or batch numbers were included on the labels of 3 out of 36 paints (8 percent of paints) included in this study. All three paints with manufacturing dates were imported from India, while the remaining 33 paints without manufacturing dates were manufactured in Ethiopia. Most warning symbols on the paint cans indicated the flammability of the paints, but no precautionary warnings on the effects of lead dust to children and pregnant women were provided.

3.6 COMPARISON WITH RESULTS FROM AN EARLIER STUDY

Lead levels in this study are consistent with the results of a similar paint study conducted by PAN-Ethiopia in 2015. In that study, 36 solvent-based paints purchased in Addis Ababa, Ethiopia were sampled and analyzed. 22 percent of the earlier paints contained less than 90 ppm lead compared to 25 percent in the current study. Similarly, a somewhat higher percentage of the paints in the former study (47 percent) contained more than 10,000 ppm lead compared to 42 percent in the current study.

The highest lead concentration detected in the 2015 study was 110,00 ppm from an orange Abay Paints. Similarly, an orange Abay Paints is one of two paints which contained the highest lead level at 100,000 ppm in the current study.

Only 2 out of 25 paints analyzed in 2015 showed a significant decrease on its lead content in the current study. The reduction in lead content was observed in two Kokeb Paints: a white paint with 4,900 ppm in 2015 to less than 80 ppm in 2017, and a red paint with 4,300 ppm in 2015 to less than 70 ppm in 2017.

TABLE 2. COMPARISON OF LEAD CONCENTRATION IN NEW SOLVENT-BASED PAINTS FROM CURRENT STUDY WITH EARLIER STUDY.

	Current Study	Previous Study
Number of Paints	36	36
Percentage of paints with lead ≥ 90 ppm (number of paints)	75 (27)	78 (28)
Percentage of paints with lead ≥ 10,000 ppm (number of paints)	42 (15)	47 (17)
Maximum Concentration, ppm	100,000	110,000

4. CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates that solvent-based paints for home use with high concentrations of lead are widely available in Ethiopia since the paints sampled for this study are brands commonly sold in retail stores all over Ethiopia. However, the fact that 9 out of 36 paints (25 percent of paints) contained lead concentrations below 90 ppm indicates that the technology to produce paints without added lead exists in Ethiopia. The study results provide a strong justification to adopt and enforce a regulation that will ban the manufacture, import, export, distribution, sale and use of paints with total lead concentrations greater than 90 ppm.

To address the problem of lead in paint, PAN-Ethiopia and IPEN propose the following recommendations:

For the Ethiopian Ministry of Environment Forest and Climate Change to immediately finalize and implement the draft a regulation that will ban the manufacture, import, export, distribution, sale and use of lead paints, i.e., paints that contain total lead concentrations exceeding 90 ppm, the most restrictive standard in the world. They should also require paint companies to display sufficient information indicating toxic content on paint can labels and provide a warning on possible lead dust hazards when distributing painted surfaces.

For paint companies that still produce lead paints to expeditiously stop the use of leaded paint ingredients in paint formulations. Paint companies that have shifted to non-lead paint production should get their products certified through independent, third party verification procedures to increase the customer's ability to choose paints with no added lead.

For paint consumers to demand paints with no added lead from paint manufacturers, as well as full disclosure of a paint product's content. Household and institutional consumers should ask for, consciously buy, and apply only paints with no added lead in places frequently used by children such as homes, schools, day care centers, parks and playgrounds.

For public health groups, consumer organizations and other concerned entities to support the elimination of lead paint, and conduct activities to inform and protect children from lead exposure through lead paint, lead in dust and soil, and other sources of lead.

For all stakeholders to come together and unite in promoting a strong policy that will eliminate lead paint in Ethiopia.

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APPENDIX

TABLE 3. SOLVENT-BASED PAINTS FOR HOME USE INCLUDED IN THE STUDY.

Sample No.	Brand	Color	Volume (L)	Price (Birr)	Date of Manu-facture (d/m/y)	Batch No.	Date of Purchase (d/m/y)	Is there website on label?
ETH-66	Mega Paints	white	1 liter	68.70	Not stated	Not given	23/06/2016	No
ETH-67	Mega Paints	yellow	1 liter	80	Not stated	Not given	23/06/2016	No
ETH-68	Mega Paints	orange	1 liter	70.20	Not stated	Not given	23/06/2016	No
ETH-69	Mega Paints	red	1 gal.	267 (66.76)	Not stated	Not given	23/06/2016	No
ETH-70	Kokeb Paints	white	1 gal.	312.10 (78)	Not stated	Not given	23/06/2016	No
ETH-71	Kokeb Paints	yellow	1 gal.	270 (67.50)	Not stated	Not given	23/06/2016	No
ETH-72	Kokeb Paints	orange	1 gal.	240 (60)	Not stated	Not given	23/06/2016	No
ETH-73	Kokeb Paints	red	1 gal.	230 (57.50)	Not stated	Not given	23/06/2016	No
ETH-74	Mural Paints	white	1 gal.	270 (67.50)	Not stated	Not given	23/06/2016	No
ETH-75	Mural Paints	yellow	1 gal.	270 (67.50)	Not stated	Not given	23/06/2016	No
ETH-76	Mural Paints	red	1 gal.	270 (67.50)	Not stated	Not given	23/06/2016	No
ETH-77	Dil Paints	white	1 gal.	270 (67.50)	Not stated	Not given	24/06/2016	No
ETH-78	Dil Paints	yellow	1 gal.	270 (67.50)	Not stated	Not given	24/06/2016	No
ETH-79	Dil Paints	orange	1 gal.	270 (67.50)	Not stated	Not given	24/06/2016	No
ETH-80	Dil Paints	red	1 gal.	270 (67.50)	Not stated	Not given	24/06/2016	No
ETH-81	Abay Paints	white	1 gal.	235 (58.75)	Not stated	Not given	23/06/2016	No

Sample No.	Brand	Color	Volume (L)	Price (Birr)	Date of Manu-facture (d/m/y)	Batch No.	Date of Purchase (d/m/y)	Is there website on label?
ETH-82	Abay Paints	yellow	1 gal.	235 (58.75)	Not stated	Not given	23/06/2016	No
ETH-83	Abay Paints	orange	1 gal.	240 (60)	Not stated	Not given	23/06/2016	No
ETH-84	Abay Paints	red	1 gal.	230 (57.50)	Not stated	Not given	23/06/2016	No
ETH-85	Tsehay Paints	white	1 gal.	250 (62.50)	Not stated	Not given	24/01/2017	No
ETH-86	Tsehay Paints	yellow	1 gal.	260 (65)	Not stated	Not given	24/01/2017	No
ETH-87	Tsehay Paints	orange	1 gal.	260 (65)	Not stated	Not given	24/01/2017	No
ETH-88	Tsehay Paints	red	1 gal.	260 (65)	Not stated	Not given	24/01/2017	No
ETH-89	Addis Synthetic Paint	white	1 gal.	445 (111.25)	Not stated	Not given	23/06/2016	No
ETH-90	Addis Synthetic Paint	yellow	1 gal.	445 (111.25)	Not stated	Not given	23/06/2016	No
ETH-91	Addis Synthetic Paint	orange	1 gal.	445 (111.25)	Not stated	Not given	23/06/2016	No
ETH-92	Addis Synthetic Paint	red	1 gal.	445 (111.25)	Not stated	Not given	23/06/2016	No
ETH-93	Kadisco Paints	white	1 liter	85	Not stated	Not given	24/06/2016	No
ETH-94	Kadisco Paints	yellow	1 gal.	330 (82.50)	Not stated	Not given	24/06/2016	No
ETH-95	Kadisco Paints	red	1 gal.	225 (56.25)	Not stated	Not given	24/06/2016	No
ETH-96	Bright Paints	white	1 gal.	258.75 (64.70)	Not stated	Not given	23/06/2016	No
ETH-97	Bright Paints	yellow	1 gal.	250.70 (62.70)	Not stated	Not given	23/06/2016	No
ETH-98	Nile Paints	yellow	1 gal.	240 (60)	Not stated	Not given	23/06/2016	No
ETH-99	Unitint Universal Stainer	yellow	50 mL	50 (1000)	Aug-16	Not given	24/01/2017	No

Sample No.	Brand	Color	Volume (L)	Price (Birr)	Date of Manu-facture (d/m/y)	Batch No.	Date of Purchase (d/m/y)	Is there website on label?
ETH-100	Unitint Universal Stainer	orange	50 mL	50 (1000)	Aug-16	Not given	24/01/2017	No
ETH-101	Unitint Universal Stainer	red	50 mL	50 (1000)	Sep-16	Not given	24/01/2017	No

TABLE 4. RESULTS OF LABORATORY ANALYSIS OF SOLVENT-BASED PAINTS FOR HOME USE.

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Manufacturer	Country of Manufacture	Is there information on can about lead content of paint?
ETH-66	Mega Paints	white	2,400	Zemilli Paint Factory	Ethiopia	No
ETH-67	Mega Paints	yellow	40,000	Zemilli Paint Factory	Ethiopia	No
ETH-68	Mega Paints	orange	36,000	Zemilli Paint Factory	Ethiopia	No
ETH-69	Mega Paints	red	2,400	Zemilli Paint Factory	Ethiopia	No
ETH-70	Kokeb Paints	white	< 80	Nefas Silk Paint Factory	Ethiopia	No
ETH-71	Kokeb Paints	yellow	98,000	Nefas Silk Paint Factory	Ethiopia	No
ETH-72	Kokeb Paints	orange	74,000	Nefas Silk Paint Factory	Ethiopia	No
ETH-73	Kokeb Paints	red	< 70	Nefas Silk Paint Factory	Ethiopia	No
ETH-74	Mural Paints	white	6,300	Mural Paints and Chemicals Plc	Ethiopia	No
ETH-75	Mural Paints	yellow	13,000	Mural Paints and Chemicals Plc	Ethiopia	No
ETH-76	Mural Paints	red	6,000	Mural Paints and Chemicals Plc	Ethiopia	No
ETH-77	Dil Paints	white	1,900	Modern Paint Industry	Ethiopia	No
ETH-78	Dil Paints	yellow	72,000	Modern Paint Industry	Ethiopia	No
ETH-79	Dil Paints	orange	100,000	Modern Paint Industry	Ethiopia	No

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Manufacturer	Country of Manufacture	Is there information on can about lead content of paint?
ETH-80	Dil Paints	red	4,300	Modern Paint Industry	Ethiopia	No
ETH-81	Abay Paints	white	4,400	Abay Paint Factory	Ethiopia	No
ETH-82	Abay Paints	yellow	70,000	Abay Paint Factory	Ethiopia	No
ETH-83	Abay Paints	orange	100,000	Abay Paint Factory	Ethiopia	No
ETH-84	Abay Paints	red	6,500	Abay Paint Factory	Ethiopia	No
ETH-85	Tsehay Paints	white	< 60	Tsehay Paint Factory	Ethiopia	No
ETH-86	Tsehay Paints	yellow	8,800	Tsehay Paint Factory	Ethiopia	No
ETH-87	Tsehay Paints	orange	4,100	Tsehay Paint Factory	Ethiopia	No
ETH-88	Tsehay Paints	red	< 60	Tsehay Paint Factory	Ethiopia	No
ETH-89	Addis Synthetic Paint	white	< 60	Addis Paint Product	Ethiopia	No
ETH-90	Addis Synthetic Paint	yellow	60,000	Addis Paint Product	Ethiopia	No
ETH-91	Addis Synthetic Paint	orange	28,000	Addis Paint Product	Ethiopia	No
ETH-92	Addis Synthetic Paint	red	5,400	Addis Paint Product	Ethiopia	No
ETH-93	Kadisco Paints	white	110	Kadisco Industry Group	Ethiopia	No
ETH-94	Kadisco Paints	yellow	73,000	Kadisco Industry Group	Ethiopia	No
ETH-95	Kadisco Paints	red	55,000	Kadisco Industry Group	Ethiopia	No
ETH-96	Bright Paints	white	< 60	Bright Paint Industry	Ethiopia	No
ETH-97	Bright Paints	yellow	19,000	Bright Paint Industry	Ethiopia	No
ETH-98	Nile Paints	yellow	13,000	Inter Emirates Ethiopian Plc	Ethiopia	No
ETH-99	Unitint Universal Stainer	yellow	< 60	Pidilite Industries Ltd	India	No
ETH-100	Unitint Universal Stainer	orange	< 60	Pidilite Industries Ltd	India	No
ETH-101	Unitint Universal Stainer	red	< 60	Pidilite Industries Ltd	India	No

TABLE 5. DISTRIBUTION OF LEAD CONCENTRATION BY BRAND.

Brand	No. of Samples	No. of Samples Above 90 ppm	No. of Samples Above 10,000 ppm	Minimum Lead Content (ppm)	Maximum Lead Content (ppm)
Mega Paints	4	4	2	2,400	40,000
Kokeb Paints	4	2	2	< 70	98,000
Mural Paints	3	3	1	6,000	13,000
Dil Paints	4	4	2	1,900	100,000
Abay Paints	4	4	2	4,400	100,000
Tsehay Paints	4	2	0	< 60	8,800
Addis Synthetic Paint	4	3	2	< 60	60,000
Kadisco Paints	3	3	2	110	73,000
Bright Paints	2	1	1	< 60	19,000
Nile Paints	1 (yellow)	1	1	13,000	13,000
Unitint Universal Stainer	3	0	0	< 60	< 60

TABLE 6. DISTRIBUTION OF LEAD CONCENTRATION BY COLOR.

Color	No. of Samples	No. of Samples Above 90 ppm	No. of Samples Above 10,000 ppm	Minimum Lead Content (ppm)	Maximum Lead Content (ppm)
White	9	5	0	< 60	6,300
Yellow	11	10	9	< 60	98,000
Orange	7	6	5	< 60	100,000
Red	9	6	1	< 60	55,000

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