ZAMBIA

LEAD IN SOLVENT-BASED PAINTS FOR HOME USE IN ZAMBIA

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CHILDREN'S ENVIRONMENTAL HEALTH FOUNDATION
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NATIONAL REPORT

LEAD IN SOLVENT-BASED PAINTS FOR HOME USE IN ZAMBIA

October 2017

Michael Musenga[1*], Allan R. Mbewe[2], and Luke Banda[2]

1 *Children's Environmental Health Foundation (CEHF), 38 Maina Soko Road, Nottie Broad, P.O. Box 60175, Livingstone.
2 University of Zambia, School of Public Health, Box 50110, Lusaka

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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 Zambia by Children's Environmental Health Foundation (CEHF) in partnership with IPEN.

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CONTENTS

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

Children's Environmental Health Foundation (**CEHF**)
P.O.Box 60175,
Livingstone, Zambia
+ 260 977 436314

cehfzambia@gmail.com
mmusenga@yahoo.com

CEHF
CHILDREN'S ENVIRONMENTAL HEALTH FOUNDATION
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PREFACE

Lead paints for home use continue to be widely produced, sold, and used in developing countries even though 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 Zambia. 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 Zambia. Finally, it proposes action steps by different stakeholders to protect children and others from lead paint.

This study was conducted by Children's Environmental Health Foundation (CEHF) in partnership with IPEN.

IPEN is an international NGO network of health and environmental organizations from all regions of the world of which CEHF 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.

Children's Environmental Health Foundation (CEHF) is a non-profit making organization that was founded in 2011 and supports sustainable environment and aims to see the standards of the environment where the Zambian child and underprivileged family live uplifted. CEHF champions the protection of children and other vulnerable population at risk from all forms of environmental health hazards and chemical threats that inhibit the development potential of children through professional execution of its plans, programs and projects. CEHF advocates for children's rights to a healthy environment, sustainable environment and food and chemical safety.

CEHF works with the Zambian Government and other stakeholders to achieve its goals. CEHF has made a lot of advancement in advocacy on the enactment of national laws and standards for elimination of lead in paint. In Octobers 2015, CEHF conducted a study to determine the levels of lead on walls of old buildings coated with oil-based paint in Lusaka and results indicated that 37 percent of paints contained lead levels above 90 ppm. The study was done in collaboration with the University of Zambia, School of Medicine and the Zambia Environmental Management Agency (ZEMA).

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 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 it 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 health 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 Zambia, there is currently no regulation in place limiting the amount of lead in paint for household and decorative use.

From September 2016 to March 2017, CEHF purchased a total of 39 cans of solvent-based paint intended for home use from stores in Lusaka, Livingstone and Choma in Zambia. The paints represented 13 different brands produced by 12 manufacturers. 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

Fourteen out of 39 analyzed solvent-based paints for home use (36 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 India, the Philippines, and the United States of America for example. Moreover, seven paints (18 percent of paints) contained dangerously high lead concentrations above 10,000 ppm. The highest lead concentration detected was 120,000 ppm in an orange Prozam Paint sold for home use.

On the other hand, 25 out of 39 solvent-based paints for home use (64 percent of paints) contained lead concentrations below 90 ppm, suggesting that the technology to produce paint without lead ingredients exists in Zambia.

Nine out of 13 analyzed brands (69 percent of paint brands) sold at least one brand of lead paint, i.e., paint with lead concentration above 90 ppm. Six out of 13 analyzed brands (46 percent of paint brands) sold at least one brand of lead paint with dangerously high concentrations above 10,000 ppm.

Yellow paints most frequently contained dangerously high lead concentrations above 10,000 ppm. Of 10 yellow paints, four (40percent of yellow paints) contained lead levels above 10,000 ppm; both two orange paints (100 percent of orange paints) contained lead levels above 10,000 ppm; and of five green paints, one (20 percent of green paints) contained lead levels above 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 "solvents, pigments and resin," 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 16 out of 39 paints (41 percent of paints) included in this study. 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 The University of Zambia (UNZA) in 2015. In that study, lead levels in forty-one brands of fresh paint each from different manufacturers were measured using flame atomic absorption spectroscopy. It was found that 37 percent of the paints contained levels of lead above 90ppm. The lead levels of paints ranged from 85 to 50,000 ppm, with a mean of 14,500 ppm and median of 15,800 ppm. This indicates that in Zambia, levels of lead in solvent-based paints among some local manufacturers are still above 90 ppm.

CONCLUSIONS

This study has demonstrated that solvent-based paints for home use with high concentrations of lead are widely available in Zambia since the paints included in this study are brands commonly sold in retail stores all over Zambia. However, the fact that 25 out of 39 paints (64 percent of paints) contained concentrations below 90 ppm indicates that the technology to produce paints without added lead exists in Zambia. The study results provide a strong justification to adopt and enforce legislation 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, CEHF and IPEN propose the following recommendations:

Government and Government Agencies

The Zambia Environmental Management Agency should immediately draft legislation that 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.

The Ministry of Water Development, Sanitation and Environmental Protection should support the drafting of the legislation and its presentation to Parliament. In addition, the Zambia Bureau of Standards should immediately start formulation of standards in accordance with 90ppm world-approved standard. The Ministry of Commerce, Trade and Industry should also support the formulation of standards while the Ministry of Health and the Ministry of Local Government should support the enforcement process through their Environmental Health Departments respectively.

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.

Figure 1: CEHF looks at the labeling of household paints sold in outlets in Livingstone, Zambia.

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 like the Zambia Institute of Environmental Health (ZIEH), consumer organizations like the Consumer Competition and Protection Commission (CCPC) and other concerned entities should support the elimination of lead paint, and conduct activities to inform the public and protect children from exposure through lead paint, lead in dust and soil, and other sources of lead.

All Stakeholders

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

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 several biological systems and pathways. The primary target is the central nervous system and the brain, but lead

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.

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 Zambia is estimated at Intl$1.44 billion, or 6.59 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, 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 ZAMBIA

There are a number of companies in the paint manufacturing and sales in Zambia with no public data on the total market sales or annual revenues. Below are the names of the companies which are market leaders in the industry:

1. Prozam Paints Limited
2. Dulux Paints Limited
3. Devin Investments
4. Plascon Zambia
5. Decotex Paints
6. Colourite Chemicals Limited
7. Insignia Africa Paints

Having all the above-mentioned players in the paint industry, the country still has no regulations and standards for lead in paint to guide the manufacturers and provide guidance for the enforcement of standards in Zambia. The only available legislation related to lead are the Government of Zambia Statutory Instrument No. 112 of 2013, The Environmental Management Act (Act No. 12 of 2011), and The Environmental Management (Licensing) Regulations, 2013 **Sections 35-38**, which states:

> *(1) A person shall not deal in a pesticide or toxic substance in a container or package without a label or a container or package that has a label which is not approved by the Agency.*
>
> *(2) A person shall apply for approval of a label for a pesticide or toxic substance in Form X set out in the First Schedule.*
>
> *(3) The Agency shall, where it approves a label*
>
> *(a) endorse its approval on the label; and*
>
> *(b) keep and maintain a sample of the approved label.*

(4) A label shall be affixed on a prominent place on the container or package containing the pesticide or toxic substance.

Sub-section 5 covers packaging of pesticides and toxic substances, labeling of pesticides and toxic substances.

(5) A pesticide or toxic substance shall not be transported within Zambia to a destination for processing, packing or re-packing for retail without the label affixed in accordance with this regulation.

(6) A person shall not use a label which contains inaccurate or false information relating to the pesticide or toxic substance.

Section 36.

(1) A person handling or using a pesticide or toxic substance shall use personal protective equipment if

(a) the pesticide or toxic substance is in the form of powder, vapour or spray droplets, the container of which bears or is required to bear a label with the word "danger" or "warning;"

(b) the application of the pesticide or toxic substance is in a confined place; or

(c) the container of that pesticide or toxic substance bears or is required to bear a label with the word "danger" or "warning."

(2) A person shall not authorise or order the wearing of a respirator when the canister or cartridge in the respirator exceeds the service life specified by the manufacturer.

(3) A child or pregnant woman shall not be employed in the handling of pesticides or toxic substances.

(4) A person shall not eat, drink or smoke whilst handling a pesticide or toxic substance.

Section 37.

(1) Pesticides and toxic substances shall be stored in a warehouse in accordance with the Twelfth Schedule.

(2) Pesticides and toxic substances shall be stored outdoors if

(a) the area is fenced and under lock and key;

(b) the floor of the storage area is made of impervious material and has containment provisions;

(c) hazard and safety signs are displayed at appropriate places in the area;

(d) the pesticides or toxic substances are covered with all-weather material; and

(d) the storage area is well ventilated at all times.

Section 38. *A pesticide or toxic substance shall be disposed of in accordance with*

(a) the scheme of disposal submitted with the application for the pesticide or toxic substance licence;

(b) the instructions on the label and accompanying leaflet of the pesticide or toxic substance; and pesticide or toxic substance; and

(c) the requirements and conditions set out in the Thirteenth Schedule.

The Standards Act No.416 of the laws of Zambia under the Bureau of Standards has no standard for lead in paint.

The results of this study will serve as guidance in the development of regulations to phase out lead in paint. The government, through the Zambia Environment Management Agency (ZEMA), has accepted the strictest global lead limit of 90ppm, which is needed to develop a mandatory regulation to phase out lead in paint. ZEMA is the leading regulatory authority in the country and is ably supported by the Zambia Bureau of Standards (ZABS).

2. MATERIALS AND METHODS

From September 2016 to March 2017,39 cans of solvent-based paint intended for home use were purchased by CEHF from various stores in Lusaka, Livingstone and Choma in Zambia. The paints represented 13 different brands produced by 12 manufacturers.

In most cases, one white paint and one or more bright-colored paint such as red, orange, green or yellow were selected for lead analysis only and not anti-corrosiveness of the products. 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 "banana cream." For all

Figure 2. Sample Preparation by CEHF team.

Figure 3: Livingstone District Commissioner** (third from left) **flagging off the beginning of paint sample preparation by CEHF team at the ZEMA office in Livingstone, Zambia

colored paints, the protocol called for obtaining "bright" or "strong" red, orange, green 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 CEHF 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, labeled wood pieces using different unused, single-use paintbrushes by a researcher of CEHF as shown in Figure 2.

Each stirring utensil and paint brush 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 forty-one to six days. After drying, the painted wood pieces were placed in individually labeled, resalable 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 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:

- Fourteen out of 39 analyzed solvent-based paints (36 percent of paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm), dry weight. In addition, seven paints (18 percent of paints) contained dangerously high lead concentrations above 10,000 ppm.
- Nine out of 13 analyzed brands (69 percent of paint brands) sold at least one brand of lead paint, i.e., paint with lead concentration above 90 ppm. Also, six out of 13 analyzed brands (46 percent of paint brands) sold at least one brand of lead paint with dangerously high lead concentrations above 10,000 ppm.
- Fourteen out of 28 bright-colored paints (50 percent of bright-colored paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm), dry weight. Yellow paints were the most hazardous with four out of 10 paints (40 percent of yellow paints) containing lead concentrations greater than 10,000 ppm; both two orange paints (100 percent of orange paints) contained lead concentrations greater than 10,000 ppm; and one out of forty-one green paints (20 percent of green paints) also contained dangerously high lead concentrations above 10,000 ppm.
- The highest concentration detected was 120,000 ppm in an orange Prozam Gloss Enamel Paint 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 "solvents, pigments and resin," 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

Fourteen out of 39 analyzed solvent-based paints (36 percent of paints) were lead paints, i.e., contained a lead concentration above 90 ppm—seven of these contained dangerously high lead concentrations above 10,000 ppm (18 percent of paints).

An orange Prozam Gloss Enamel Paint contained the highest concentration of lead at 120,000 ppm, while the lowest concentration of lead less than 60 ppm was detected in 24 paints from the following brands: African Paint (red and white); Colorite (red and white); Colosul (white); Coral (red enamel paint, red floor paint, white and yellow); Decotex (white); Dulux (white); Galaxy (yellow); Goldstar (red, white and yellow); Magic Paint (red and white); Permolux (white); Plascon V.I.P. (red and white); Prozam (green, red and white); and Tuff Stuff (red).

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.

Sample No.	Brand	Country of Manufacturer	Color	Lead Content (ppm)
ZAM-10	Prozam Paint	Prozam Pants Ltd	orange	120,00
ZAM-37	Dulux Paint	Dulux Paints Ltd	yellow	88,000
ZAM-16	African Paint	Devin Investment Ltd	yellow	80,000
ZAM-35	Plascon V.I.P. Paint	Plascon Zambia Ltd	yellow	56,000
ZAM-18	Decotex Paint	Decotex Paints Ltd	yellow	37,000
ZAM-5	Colorite Paint	Colour Rite Chemicals Ltd	orange	33,000
ZAM-6	Colorite Paint	Colour Rite Chemicals Ltd	green	13,000
ZAM-4	Colorite Paint	Colour Rite Chemicals Ltd	yellow	7,200
ZAM-8	Prozam Paint	Prozam Paints Ltd	yellow	3,000
ZAM-13	Galaxy Floor Paint	Insignia (Africa) Ltd	green	1,500

3.3 PAINT BRAND ANALYSIS

Six out of 13 analyzed brands (46 percent of paint brands) sold, there was at least one brand of paint with dangerously high lead concentration above 10,000 ppm.

Among solvent-based decorative paints, a yellow Prozam Paint contained the highest concentration of lead at 120,000 ppm. On the other hand, at least one paint from each of the following brands contained lead below 90 ppm: African Paint (red and white); Colorite (green, red and white); Colosul (white); Coral (red enamel paint, red floor paint, white and yellow); Decotex (white); Dulux (white); Galaxy (yellow); Goldstar (red, white and yellow); Magic Paint (red and white); Permolux (white); Plascon V.I.P. (red and white); Prozam (green, red and white); and Tuff Stuff (red).This indicates that the technology to produce paints without added lead exists in Zambia.

3.4 PAINT COLOR ANALYSIS

Twenty-eight out of 34 bright-colored paints (82 percent of bright-colored paints) such as yellow, orange, red and green contained lead concentrations above 90 ppm, 11 paints of which contained dangerously high lead concentrations above 10,000 ppm (32 percent of bright-colored paints).

This study further revealed that 14 out of 28 bright-colored paints (50 percent of bright-colored paints) such as yellow, orange and green contained lead concentrations above 90 ppm, seven paints of which contained dangerously high lead concentrations above 10,000 ppm (25 percent of bright-colored paints). These findings include 11 red paints, 11 white paints, 10 yellow paints, five green paints, and two orange paints. Yellow, orange and green paints contained the highest lead concentrations.

Among bright-colored paints, seven out of 10 yellow paints (70 percent of yellow paints) contained lead concentrations above 90 ppm, four paints of which exceeded more than 10,000 ppm of lead (40 percent of yellow paints). In addition, two orange paints (100 percent of orange paints) contained lead concentrations above 90 ppm, both of which exceeded more than 10,000 ppm of lead (100 percent of orange paints); three out of five green paints (60 percent of green paints) contained lead concentrations above 90 ppm, one paint of which exceeded more than 10,000 ppm of lead (20 percent of green paints); and two out of 11 red paints (18 percent of red paints) contained lead concentrations above 90 ppm. The distribution of lead concentrations in different colors is shown in Figure 4.

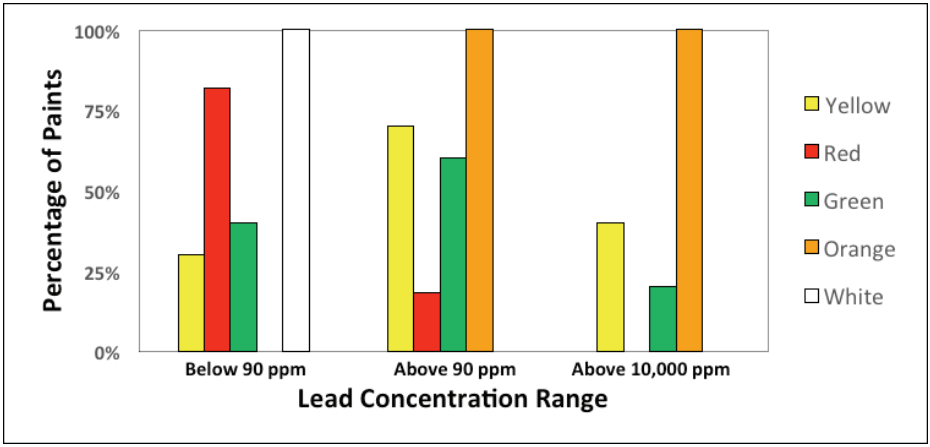

Figure 4. Distribution of lead concentrations in home-use solvent-based paints by color.

3.5 LABELING

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

This was because 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 "solvents, pigments and resin," 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 16 out of 39 paints (41 percent of paints) included in this study. 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 CEHF and the University of Zambia (UNZA) in October 2015. In that study, forty-one solvent-based paints from different manufacturers were measured using flame-atomic absorption spectroscopy in Lusaka, Zambia. It was found that 73 percent of the paints had lead levels above 90 ppm. The lead levels of paints ranged from 85 to 50,000 ppm, with a mean of 14,500 ppm and median of 15,800 ppm. Similarly, a very high percentage of the paints in the

former study (37 percent) contained more than 10,000 ppm lead compared to 18 percent in the current study.

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

	Current Study	Previous Study (2015)
Number of Paints	39	41
Percentage of paints with lead ≥ 90 ppm (number of paints)	36 (14)	73 (30)
Percentage of paints with lead ≥ 10,000 ppm (number of paints)	18 (7)	37 (11)
Maximum Concentration, ppm	120,000	50,000

4. CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates that solvent-based paints for home use with high concentrations of lead are widely available in Zambia since the paints sampled for this study are brands commonly sold in retail stores all over Zambia. However, the fact that 25 out of 39 paints (64 percent of paints) contained lead concentrations below 90 ppm indicates that the technology to produce paints without added lead exists in Zambia. 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, CEHF and IPEN propose the following recommendations:

The Zambia Environmental Management Agency (ZEMA) to immediately 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 disturbing painted surfaces. The provisions of the Environmental Management Act (Act No 12 of 2011), the Standards Act Cap 416 and the Food and Drugs Act Cap 303 of the laws of Zambia are some of the legal enforcement tools that can be used in the enforcement and education processes.

All 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.

Paint consumers to demand paints with no added lead from paint manufacturers, as well as full disclosure of a paint product's lead 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.

Public health groups like the Zambia Institute of Environmental Health (ZIEH), consumer organizations like the Consumer Competition and Protection Commission (CCPC) and other concerned entities to support the elimination of lead paint, and conduct activities to inform the public and protect children from lead exposure through lead paint, lead in dust and soil, and other sources of lead.

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

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APPENDIX

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

Sample No.	Brand	Color	Price (ZMW)*	Date of Manufacture (y/m/d)	Batch No.	Is there website on label?
ZAM-01	Tuff Stuff Paint	Red	50	Nil	Nil	www.tuffstuffchemicals.com
ZAM-02	Colorite Paint	White	60	Nil	Nil	www.colourritechemical.com
ZAM-03	Colorite Paint	Red	40	Nil	Signal Red 04E53	www.colourritechemical.com
ZAM-04	Colorite Paint	Yellow	40	Nil	Bright Yellow 10E49	www.colourritechemical.com
ZAM-05	Colorite Paint	Orange	40	Nil	Orange D803	www.colourritechemical.com
ZAM-06	Colorite Paint	Green	55	Nil	Don Green 14E53	www.colourritechemical.com
ZAM-07	Prozam Paint	White	60	Nil	Nil	www.prozampaints.com
ZAM-08	Prozam Paint	Yellow	70	Nil	Nil	www.prozampaints.com
ZAM-09	Prozam Paint	Red	70	Nil	Nil	www.prozampaints.com
ZAM-10	Prozam Paint	Orange	70	Nil	Nil	www.prozampaints.com
ZAM-11	Prozam Paint	Green	70	Nil	Nil	www.prozampaints.com
ZAM-12	Coral Floor Paint	Red	60	Nil	Nil	www.insignia.co.tz
ZAM-13	Galaxy Floor Paint	Green	65	Nil	Nil	www.insignia.co.tz
ZAM-14	African Paint	White	48	2016/06/03	B.No.D. 0306-16	No
ZAM-15	African Paint	Red	48	2016/07/20	B.No.C. 0207-16	No
ZAM-16	African Paint	Yellow	48	16/04	B.No.C.- 01016	No
ZAM-17	Decotex Paint	White	50	Nil	White00E55	www.decotexpaints.com
ZAM-18	Decotex Paint	Yellow	56	Nil	Brilliant Yellow 10E50	www.decotexpaints.com
ZAM-19	Decotex Paint	Red	56	Nil	Signal Red 04E53	www.decotexpaints.com

** Exchange rate US$1.00 = ZMW9.00.*

Sample No.	Brand	Color	Price (ZMW)*	Date of Manufacture (y/m/d)	Batch No.	Is there website on label?
ZAM-20	Coral Paint	White	35	2016/04	B.No-732	www.insignia.co.tz
ZAM-21	Coral Paint	Red	60	2016/06/25	B.No-1256	www.insignia.co.tz
ZAM-22	Coral Paint	Yellow	60	2015/12	B.No-2527	www.insignia.co.tz
ZAM-23	Coral Paint	Green	60	Nil	Nil	www.insignia.co.tz
ZAM-25	Colorite Roof Enamel Paint	Red	60	Nil	Nil	www. colourritechemical.com
ZAM-26	Colorite Roof Enamel Paint	Green	60	Nil	Nil	www. colourritechemical.com
ZAM-27	Magic Paint	White	50	Nil	Nil	www.magicpaint.co.zm
ZAM-28	Magic Paint	Red	50	Nil	Nil	www.magicpaint.co.zm
ZAM-29	Magic Paint	Yellow	45	Nil	Nil	www.magicpaint.co.zm
ZAM-30	Goldstar Paint	White	40	Nil	Nil	www.goldstarpaints. com
ZAM-31	Goldstar Paint	Red	40	Nil	Nil	www.goldstarpaints. com
ZAM-32	Goldstar Paint	Yellow	40	Nil	Nil	www.goldstarpaints. com
ZAM-33	Plascon V.I.P. Paint	White	65	Nil	Nil	No
ZAM-34	Plascon V.I.P. Paint	Red	65	Nil	Nil	No
ZAM-35	Plascon V.I.P. Paint	Yellow	65	Nil	Nil	No
ZAM-36	Galaxy Paint	Yellow	50	2014/08/15	B/N 1980	www.insignia.co.tz
ZAM-37	Dulux Paint	Yellow	150	Nil	BN120830	www.dulux.co.za
ZAM-38	Dulux Paint	White	40	Nil	Nil	www.dulux.co.za
ZAM-39	Permolux Paint	White	63	Nil	Nil	No
ZAM-40	Colosul Paint	White	140	Nil	00E55	No

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

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Country of Manufacture	Is there information on can about lead content of paint?
ZAM-01	Tuff Stuff	Red	< 60	Zambia	No
ZAM-02	Colorite	White	< 60	Zambia	No
ZAM-03	Colorite	Red	1,000	Zambia	No
ZAM-04	Colorite	Yellow	7,200	Zambia	No
ZAM-05	Colorite	Orange	33,000	Zambia	No
ZAM-06	Colorite	Green	13,000	Zambia	No
ZAM-07	Prozam	White	< 60	Zambia	No
ZAM-08	Prozam	Yellow	3,000	Zambia	No
ZAM-09	Prozam	Red	< 60	Zambia	No
ZAM-10	Prozam	Orange	120,000	Zambia	No
ZAM-11	Prozam	Green	< 60	Zambia	No
ZAM-12	Coral Floor Paint	Red	< 60	Tanzania	No
ZAM-13	Galaxy Floor Paint	Green	1,500	Zambia	No
ZAM-14	African	White	< 60	Zambia	No
ZAM-15	African	Red	< 60	Zambia	No
ZAM-16	African	Yellow	80,000	Zambia	No
ZAM-17	Decotex	White	< 60	Zambia	No
ZAM-18	Decotex	Yellow	37,000	Zambia	No
ZAM-19	Decotex	Red	660	Zambia	No
ZAM-20	Coral	White	< 60	Tanzania	No
ZAM-21	Coral	Red	< 60	Tanzania	No
ZAM-22	Coral	Yellow	< 60	Tanzania	No
ZAM-23	Coral	Green	100	Tanzania	No
ZAM-25	Colorite Roof Enamel Paint	Red	< 60	Zambia	No
ZAM-26	Colorite Roof Enamel Paint	Green	61	Zambia	No
ZAM-27	Magic	White	< 60	Zambia	No

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Country of Manufacture	Is there information on can about lead content of paint?
ZAM-28	Magic	Red	< 60	Zambia	No
ZAM-29	Magic	Yellow	1,100	Zambia	No
ZAM-30	Goldstar	White	< 60	Tanzania	No
ZAM-31	Goldstar	Red	< 60	Tanzania	No
ZAM-32	Goldstar	Yellow	< 60	Tanzania	No
ZAM-33	Plascon V.I.P.	White	< 60	Zambia	No
ZAM-34	Plascon V.I.P.	Red	< 60	Zambia	No
ZAM-35	Plascon V.I.P.	Yellow	56,000	Zambia	No
ZAM-36	Galaxy	Yellow	< 60	Zambia	No
ZAM-37	Dulux	Yellow	88,000	South Africa	No
ZAM-38	Dulux	White	< 60	Zambia	No
ZAM-39	Permolux	White	< 60	Zambia	No
ZAM-40	Colosul	White	< 60	Zambia	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)
Colorite	7	4	2	< 60	33,000
Prozam	5	2	1	< 60	120,000
Coral	5	1	0	< 60	100
African	3	1	1	< 60	80,000
PlasconV.I.P.	3	1	1	< 60	56,000
Decotex	3	2	1	< 60	37,000
Magic	3	1	0	< 60	1,100
Goldstar	3	0	0	< 60	<6 0
Dulux	2	1	1	< 60	88,000
Galaxy	2	1	0	< 60	1,500
Permolux	1 (white)	0	0	< 60	< 60
Colosul	1 (white)	0	0	< 60	< 60
Tuff Stuff	1 (red)	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)
Red	11	2	0	< 60	1,000
White	11	0	0	< 60	< 60
Yellow	10	7	4	< 60	88,000
Green	5	3	1	< 60	13,000
Orange	2	2	2	33,000	120,000

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ipen@ipen.org

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