MONGOLIA

LEAD IN SOLVENT-BASED PAINTS FOR HOME USE IN MONGOLIA

October 2017

ZORIG FOUNDATION

SWEDEN

IPEN
a toxics-free future

NATIONAL REPORT

LEAD IN SOLVENT-BASED PAINTS FOR HOME USE IN MONGOLIA

October 2017

ACKNOWLEDGMENTS

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

We would like to express our special thanks of gratitude to David Warburton, OBE, DSc, MD, MMM, FRCP, FRCS, FRCPCH, as well as Purevdorj B. Olkhanud, MD, MPH, PhD and Oyun Sanjaasuren, PhD.

The analytical study providing data to this report was undertaken as part of IPEN's Global Lead Paint Elimination Campaign. It was conducted in Mongolia by Zorig Foundation in partnership with IPEN, and funded by the New York Community Trust (NYCT) and the Swedish Government.

While this study was undertaken with funding assistance from the New York Community Trust and the Swedish Government, responsibility for the content lies entirely with IPEN and Zorig Foundation. The New York Community Trust and the Swedish Government 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

Zorig Foundation
Zorig Foundation Building, Peace Avenue 17,
Sukhbaatar District,
Ulaanbaatar City, Mongolia
+ (976) 11-315444

http://zorigsan.mn/en/?menuid=90

ZORIG
FOUNDATION

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 Mongolia. 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 import, sale, and use of lead paint, and provides a strong justification to adopt and enforce further regulatory controls in Mongolia. Finally, it proposes action steps by different stakeholders to protect children and others from lead paint.

This study was conducted by Zorig Foundation in partnership with IPEN.

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

Zorig Foundation is a non-profit and non-government organization that aims to promote democracy through three main areas of focus, including a) good

governance, b) community development, and c) youth and education. Currently, the majority of Zorig Foundation's activities are focused on youth and education programs. Projects and programs directed towards the development of youth in Mongolia started in 2000 with a university scholarship program. Zorig Foundation has administered over 2200 scholarships to date, making it the largest provider of scholarships in Mongolia. Zorig Foundation is also known for its leadership programs for young professionals including Young Leadership Program, Rural Young Leadership Program, Environmental Fellowship Program and Rural Environmental Fellowship Program. Environmental Fellowship Program is an 8-month program for young professionals interested in increasing their awareness and understanding of issues affecting the conservation and security of the Mongolian ecosystem. The program aims to enable fellows to play a future leadership role in helping to sustain and improve Mongolia's ecological heritage. This study was conducted by participants of Environmental Fellowship Program.

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 Mongolia, there is currently no regulation established to limit the amount of lead in paints used for household and decorative purposes.

From February to March 2017, Zorig Foundation purchased a total of 56 cans of solvent-based paint intended for home use from stores in Zuun Ail, Ulaanbaatar, Mongolia, which is considered to be the biggest market for paint trade. The paints represented 25 different brands produced by 22 manufacturers. None of these paints were produced in Mongolia since it lacks national paint manufacturing industry. 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

Thirty-nine out of 56 analyzed solvent-based paints for home use (70 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, 11 paints (20 percent of paints) contained dangerously high lead concentrations above 10,000 ppm. The highest lead concentration detected was 71,000 ppm in a yellow enamel paint manufactured in China and sold for home use in Mongolia.

On the other hand, 17 out of 56 solvent-based paints for home use (30 percent of paints) contained lead concentrations below 90 ppm, suggesting that the technology to produce paint without lead ingredients exists in countries exporting their paints to Mongolia.

Nineteen out of 25 analyzed brands (76 percent of paint brands) sold at least one lead paint, i.e., a paint with lead concentration above 90 ppm. Ten out of 25 analyzed brands (40 percent of paint brands) sold at least one lead paint with dangerously high lead concentrations above 10,000 ppm.

Among decorative paints, yellow-colored paints most frequently contained dangerously high lead concentrations above 10,000 ppm. Of 14 yellow paints, nine (64 percent of yellow-colored decorative paints) contained lead levels above 10,000 ppm; of three orange paints, one (33 percent of orange-colored paints) contained lead levels above 10,000 ppm and of 14 red paints, one (7 percent of red-colored paints) contained lead levels above 10,000 ppm.

None of the three anticorrosive paints contained lead levels above 90 ppm.

In general, paint can labels did not carry meaningful information about lead content or the hazards of lead paint. Only one out of the 56 paints provided information about lead on its label indicating that "lead is harmful to health," 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 were present in 42 out of 56 paints (75 percent of paints) and batch numbers were included on the labels of 28 out of 56 paints (50 percent of paints) included in this study. Most warning symbols

on the paint cans indicated the flammability of the paints, but had 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 General Physics Department, School of Physics and Electronics, National University of Mongolia in 2014. In that study, 15 solvent-based paints from four brands were purchased and analyzed. In the previous study, 11 of 15 paints (73 percent of paints) contained lead levels above 90 ppm, and two of 15 paints (13 percent of paints) contained lead levels above 10,000 ppm. The highest amount of lead in that study was 25,000 ppm. Even though some of the results of the two studies differ, the yellow-colored paints of two similar brands in both studies had lead content above 10,000 ppm.

CONCLUSIONS

This study demonstrates that solvent-based paints for home use with high concentrations of lead are widely available in Mongolia since the paints included in this study are brands commonly sold in retail stores all over Mongolia. Since Mongolia lacks national paint manufacturing industry, it is clear that strict regulations on imported paint is crucial to eliminate lead paint from the market. Also, the fact that 17 out of 56 paints (30 percent of paints) manufactured in China, Korea and Russia contained lead concentrations below 90 ppm indicates that the technology to produce paints without added lead exists in these countries. 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, Zorig Foundation and IPEN propose the following recommendations:

Government and Government Agencies

The Government of Mongolia should immediately draft a regulation that will ban the import, sale, and use of paints containing 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 importers and dealers should offer duly certified and labeled paint products 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 Mongolia.

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 Mongolia is estimated at Intl$491 million, or 3.68 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 MONGOLIA

The paint industry in Mongolia is dominated by the imported paints from China, Russia and other countries. Due to heavy investment requirement and lack of raw material availability, Mongolia lacks paint manufacturing industry. Mongolian customs statistics report shows that a total of 3,600 kg of paints, with retail cost of about $2.4 million US dollars, were imported in 2016, and another 3,600 kg of paints which costs about $2.6 million US dollars were imported in 2015. The construction sector in Mongolia is currently facing difficult times due to present economic conditions, and consequently, the quantity of imported paints went down by 2.35 percent in 2016 as compared to 2015.

There is currently no existing mandatory standard which limits the use of lead in paints imported to and sold in Mongolia.

Lead is listed as a toxic chemical under the Toxic and Hazardous Chemical Law of Mongolia.

2. MATERIALS AND METHODS

From February to March 2017, 56 cans of solvent-based paint intended for home use were purchased by Zorig Foundation from various stores in Zuun Ail, Ulaanbaatar, Mongolia. The paints represented 25 different brands produced by 22 manufacturers.

In most cases, one white paint and one or more bright-colored paint such as red, orange or yellow were selected. Additionally, three anticorrosive paints 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 Zorig Foundation 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 Zorig Foundation 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 labeled, 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 an independent quality assurance testing. This was made by sending paint

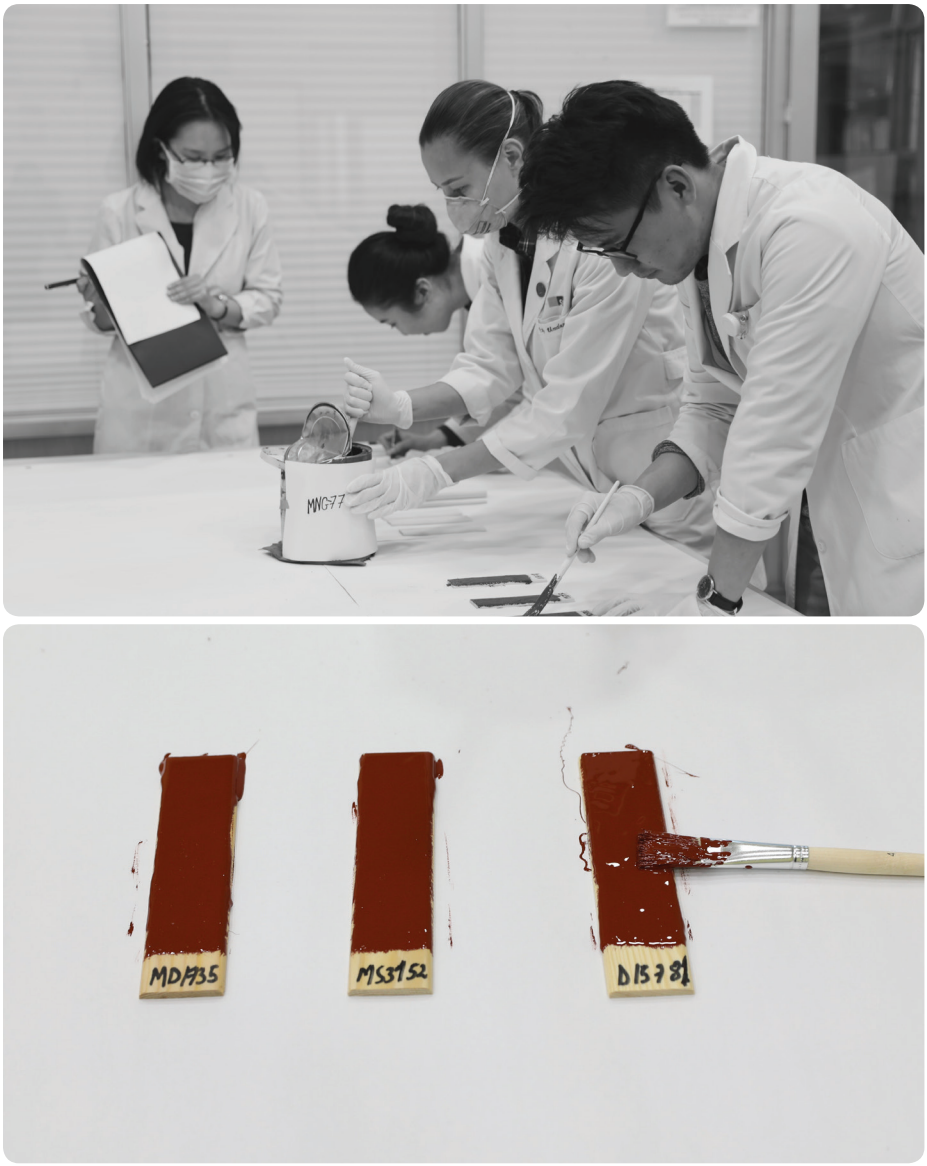

Figure 1. Preparation of Paint Samples.

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:

- 39 out of 56 analyzed solvent-based paints (70 percent of paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm), dry weight. In addition, 11 paints (20 percent of paints) contained dangerously high lead concentrations above 10,000 ppm.
- 19 out of 25 analyzed brands (76 percent of paint brands) sold at least one lead paint, i.e., a paint with lead concentration above 90 ppm. Also, 10 out of 25 analyzed brands (40 percent of paint brands) sold at least one lead paint with dangerously high lead concentrations above 10,000 ppm.
- 28 out of 34 bright-colored paints (82 percent of bright-colored paints) were lead paints, i.e., they contained lead concentrations above 90 parts per million (ppm), dry weight. Yellow-colored paints were the most hazardous with nine out of 15 paints (60 percent of yellow paints) containing lead concentrations greater than 10,000 ppm; one out of three orange-colored paints (33 percent of orange paints) and one out of 14 red-colored paints (7 percent of red paints) also contained dangerously high lead concentrations above 10,000 ppm.
- The highest lead concentration detected was 71,000 ppm in a yellow enamel paint manufactured in China and sold for home use.
- Only one out of 56 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

Thirty-nine out of 56 analyzed solvent-based paints (70 percent of paints) were lead paints, i.e., contained a lead concentration above 90 ppm — 11 of these contained dangerously high lead concentrations above 10,000 ppm (20 percent of paints).

A yellow enamel paint manufactured in China contained the highest concentration of lead at 71,000 ppm, while the lowest concentration of lead less than 60 ppm was detected in 13 paints from the following brands: Aodanpai (white); Bao Chang (white); Chulei (white); Fish Friend (red, white); Formula Q8 (white); Gaopinwei Chunsuan Youqi (white); Honglian (red); Kapral Universal Emali (white); Master (grey); NC Paint (white); Olecolor (white); and Yarko (yellow). These paints were manufactured in China, Korea and Russia, suggesting that the technology to produce paint without lead ingredients exists in these countries.

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	Country of Manufacturer	Color	Lead Content (ppm)
1	MNG-30	Brand-01	China	yellow	71,000
2	MNG-63	Brand-17	Germany	red	67,000
3	MNG-26	Brand-15	China	yellow	47,000
4	MNG-12	Brand-12	China	yellow	36,000
5	MNG-58	Brand-02	China	yellow	34,000
6	MNG-83	Brand-08	China	orange	31,000
7	MNG-51	Brand-14	China	yellow	31,000
8	MNG-78	Brand-07	China	yellow	27,000
9	MNG-55	Brand-08	China	yellow	24,000
10	MNG-01	Brand-06	Korea	yellow	13,000

3.3 PAINT BRAND ANALYSIS

Ten out of 25 analyzed brands (20 percent of paint brands) sold at least one paint with dangerously high lead concentration above 10,000 ppm.

Among solvent-based decorative paints, a yellow enamel paint manufactured in China contained the highest concentration of lead at 71,000 ppm. On the other hand, at least one paint from each of the following brands contained lead below 90 ppm: Aodanpai (white); Bao Chang (white); Chulei (white); Dong Kyu (orange); Fabritex Emali Alkidnaya (green); Fish Friend (red, white); Formula Q8 (white); Gaopinwei Chunsuan Youqi (white); Glavnii Technology (yellow); Honglian (red, white); Kapral Universal Emali (white); Master (grey); NC Paint (white); Olecolor (white); and Yarko (yellow).

On the other hand, two anticorrosive paints from the brands Master (grey) and Olecolor (white) contained lead concentrations below 60 ppm, while one anticorrosive paint from the brand Glavnii Technology (yellow) contained lead concentration below 70 ppm.

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 included 15 yellow paints, 14 red paints, three orange paints and 2 green paints. Yellow, orange and red paints contained the highest total lead concentrations.

Among bright-colored decorative paints, 13 out of 14 yellow paints (93 percent of yellow decorative paints) contained lead concentrations above 90 ppm, nine paints of which levels exceeded more than 10,000 ppm of lead (64 percent of yellow decorative paints); 12 out of 14 red paints (86 percent of red paints) contained lead concentrations above 90 ppm, one paint of which exceeded more than 10,000 ppm of lead (7 percent of red paints); two out of three orange paints (67 percent of orange paints) contained lead concentrations above 90 ppm, one paint of which exceeded more than 10,000 ppm of lead (33 percent of orange paints); and one out of two green paints (50 percent of green paints) contained lead concentrations above 90 ppm.

None of the three anticorrosive paints contained lead levels above 90 ppm.

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

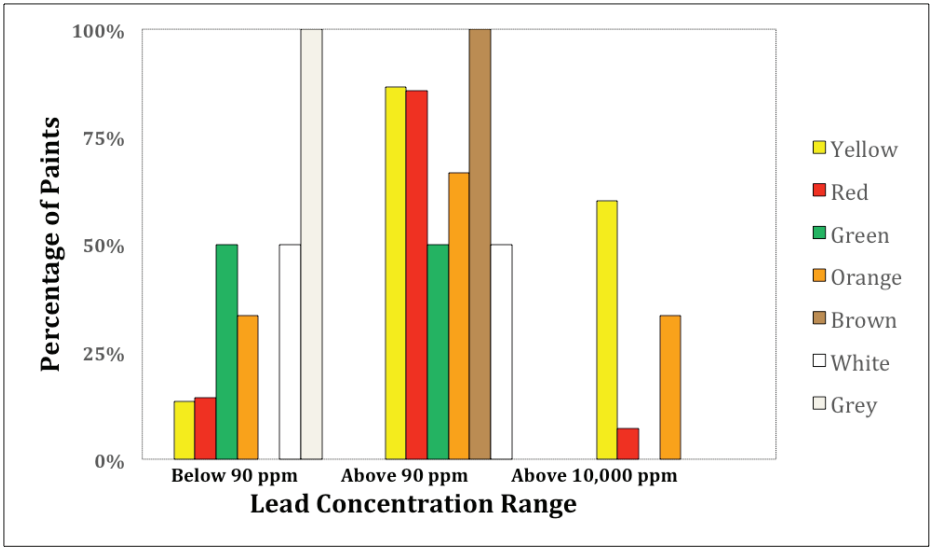

Figure 2. Distribution of lead concentrations in home-use solvent-based paints by color.

3.5 LABELING

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

Only one out of 56 paints provided information about lead on their labels and most paint can labels carried little information about any ingredients. A red enamel paint containing 67,000 ppm lead had a mark on its label which said, "Lead is harmful to health." 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 were present in 42 out of 56 paints (75 percent of paints) and batch numbers were included on the labels of 28 out of 56 paints (50 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 the General Physics Department, School of Physics and Electron-

ics, National University of Mongolia in 2014.[17] In that study, 15 solvent-based paints from four brands were purchased and analyzed. In the previous study, 11 of 15 paints (73 percent of paints) contained lead levels above 90 ppm, and two of 15 paints (13 percent of paints) contained lead levels above 10,000 ppm. The highest amount of lead in that study was 25,000 ppm. Even though some of the results of the two studies differ, the yellow-colored paints of two similar brands in both studies had lead content above 10,000 ppm.

4. CONCLUSIONS AND RECOMMENDATIONS

This study demonstrates that solvent-based paints for home use with high concentrations of lead are widely available in Mongolia since the paints sampled for this study are brands commonly sold in retail stores all over Mongolia. Since Mongolia lacks national paint manufacturing industry, it is clear that strict regulations on imported paint is crucial to eliminate lead paint from the market. Also, the fact that 17 out of 56 paints (30 percent of paints) manufactured in China, Korea and Russia contained lead concentrations below 90 ppm indicates that the technology to produce paints without added lead exists in these countries. 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, Zorig Foundation and IPEN propose the following recommendations:

For the Government of Mongolia 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.

For paint importers and dealers to offer duly certified and labeled paint products 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 Mongolia.

REFERENCES

[1] Clark, S., et al., Occurrence and determinants of increases in blood lead levels in children shortly after lead hazard control activities. Environmental Research, 2004. 96(2): p. 196-205.
[2] World Health Organization. Childhood lead poisoning. 2010.
[3] Lanphear, B.P., et al., The contribution of lead-contaminated house dust and residential soil to children's blood lead levels. Environmental Research, 1998. 79(1): p. 51-68.
[4] Bellinger, D.C., Very low lead exposures and children's neurodevelopment. Current Opinion in Pediatrics, 2008. 20(2): p. 172-177.
[5] Bjorklund, K.L., et al., Metals and trace element concentrations in breast milk of first time healthy mothers: a biological monitoring study. Environmental Health, 2012. 11.
[6] Needleman, H., Lead Poisoning. Annual Review of Medicine, 2004. 55(1): p. 209-222.
[7] Iavicoli, I., L. Fontana, and A. Bergamaschi, THE EFFECTS OF METALS AS ENDOCRINE DISRUPTORS. Journal of Toxicology and Environmental Health-Part B-Critical Reviews, 2009. 12(3): p. 206-223.
[8] Verstraeten, S., L. Aimo, and P. Oteiza, Aluminium and lead: molecular mechanisms of brain toxicity. Archives of Toxicology, 2008. 82(11): p. 789-802.
[9] Prüss-Üstün, A. and C. Corvalán Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease. 2006.
[10] World Health Organization. Lead poisoning and health. 2015; Available from: http://www.who.int/mediacentre/factsheets/fs379/en/.
[11] Mielke, H.W. and S. Zahran, The urban rise and fall of air lead (Pb) and the latent surge and retreat of societal violence. Environment International, 2012. 43: p. 48-55.
[12] Attina, T.M. and L. Trasande, Economic Costs of Childhood Lead Exposure in Low- and Middle-Income Countries. Environmental Health Perspectives, 2013. 121(9): p. 1097-1102.
[13] Brosché, S., et al., Asia Regional Paint Report. 2014.
[14] Clark, C.S., et al., The lead content of currently available new residential paint in several Asian countries. Environmental Research, 2006. 102(1): p. 9-12.
[15] Clark, C.S., et al., Lead levels in new enamel household paints from Asia, Africa and South America. Environmental Research, 2009. 109(7): p. 930-936.
[16] World Health Organization, Brief guide to analytical methods for measuring lead in paint. 2011, WHO Library Cataloguing-in-Publication Data.
[17] R. Galbadrakh, et al., Determination Results of Heavy Contaminant Elements Lead, Cadmium, Chromium, Selenium, and Arsenic in Samples of Oil and Ochre Paint Brands Best Selling in Ulaanbaatar City Market Places, 2014: p3.

APPENDIX

TABLE 2. SOLVENT-BASED PAINTS FOR HOME USE INCLUDED IN THE STUDY.

Sample No.	Brand	Color	Volume (L)	Price (MNT)	Date of Manufacture (y/m/d)	Batch No.	Date of Purchase (y/m/d)	Is there website on label?
MNG-77	Brand-01	red	1	4500	4/6/2016	none	2/19/2017	No
MNG-30	Brand-01	yellow	1	4500	17/5/2016	none	2/19/2017	No
MNG-82	Brand-01	white	1	4000	5/9/2016	none	2/19/2017	No
MNG-49	Brand-02	red	1	4500	22/9/2016	none	2/19/2017	Yes
MNG-58	Brand-02	yellow	1	4500	5/6/2015	none	2/19/2017	Yes
MNG-62	Brand-02	white	1	4000	19/11/2016	none	2/19/2017	Yes
MNG-76	Brand-03	brown	0.9	8000	4/6/2016	782-6	2/19/2017	Yes
MNG-54	Brand-04	red	0.9	6000	6/16	1934	2/19/2017	No
MNG-44	Brand-04	yellow	0.9	6000	5/16	1440	2/19/2017	No
MNG-46	Brand-04	white	0.9	6000	none	none	2/19/2017	No
MNG-20	Brand-05	red	0.9	5500	22/5/2016	6156	2/19/2017	Yes
MNG-09	Brand-05	yellow	0.9	5500	none	none	2/19/2017	Yes
MNG-25	Brand-05	white	0.9	5000	24/6/2016	6994	2/19/2017	Yes
MNG-05	Brand-06	white	1	11000	22/10/2016	801610221	2/19/2017	No
MNG-01	Brand-06	yellow	1	11000	2/3/2015	801503021	2/19/2017	No
MNG-78	Brand-07	yellow	1	3500	7/10/2016	none	2/19/2017	No

Sample No.	Brand	Color	Volume (L)	Price (MNT)	Date of Manufacture (y/m/d)	Batch No.	Date of Purchase (y/m/d)	Is there website on label?
MNG-79	Brand-07	red	1	3500	3/9/2016	none	2/19/2017	No
MNG-13	Brand-07	white	1	3500	18/10/2016	none	2/19/2017	No
MNG-74	Brand-08	white	1	4000	none	none	2/19/2017	No
MNG-55	Brand-08	yellow	1	4000	none	none	2/19/2017	No
MNG-53	Brand-08	red	1	4000	none	none	2/19/2017	No
MNG-83	Brand-08	orange	1	4000	11/6/2016	none	2/19/2017	No
MNG-02	Brand-09	white	1	4500	8/10/1/2016	C03-1	2/19/2017	No
MNG-42	Brand-10	red	1	6500	6/16	2579	2/19/2017	Yes
MNG-18	Brand-10	white	1	6500	9/16	1659	2/19/2017	Yes
MNG-15	Brand-10	yellow	1	6500	7/16	2663	2/19/2017	Yes
MNG-29	Brand-11	white	1	7000	none	none	2/19/2017	Yes
MNG-59	Brand-11	orange	1	7000	30/8/2016	1773-6	2/19/2017	Yes
MNG-75	Brand-11	yellow	1	7000	13/9/2016	1818-6	2/19/2017	Yes
MNG-38	Brand-11	green	1	7500	none	none	2/19/2017	Yes
MNG-12	Brand-12	yellow	1	4000	none	none	2/19/2017	No
MNG-16	Brand-13	white	1	4500	5/8/2016	1	2/19/2017	No
MNG-84	Brand-13	red	1	4500	16/6/2016	1	2/19/2017	No
MNG-51	Brand-14	yellow	1	4500	9/18/2015	none	2/19/2017	No
MNG-64	Brand-14	red	1	4500	21/3/2014	none	2/19/2017	No
MNG-04	Brand-14	white	1	4500	21/8/2015	none	2/19/2017	No
MNG-39	Brand-15	red	1	5000	27/6/2015	15-71	2/19/2017	No

Sample No.	Brand	Color	Volume (L)	Price (MNT)	Date of Manufacture (y/m/d)	Batch No.	Date of Purchase (y/m/d)	Is there website on label?
MNG-26	Brand-15	yellow	1	5000	15/9/2015	15-95	2/19/2017	No
MNG-52	Brand-15	white	1	5000	6/10/2015	15-102	2/19/2017	No
MNG-40	Brand-16	white	1	12000	19/9/2015	20150619001	2/19/2017	No
MNG-65	Brand-16	red	1	12000	25/8/2014	20140825001	2/19/2017	No
MNG-85	Brand-16	orange	1	12000	none	none	2/19/2017	No
MNG-63	Brand-17	red	1	11000	none	none	2/19/2017	No
MNG-69	Brand-18	white	1	5500	none	none	2/19/2017	Yes
MNG-68	Brand-19	white	1	5000	9/16	5350/1	2/19/2017	No
MNG-27	Brand-20	white	1	5500	none	none	2/19/2017	No
MNG-17	Brand-20	red	1	5500	7/16	4517/2	2/19/2017	No
MNG-06	Brand-20	yellow	1	5500	6/16	3608/1	2/19/2017	No
MNG-03	Brand-20	green	1	5500	4/16	1667/1	2/19/2017	No
MNG-61	Brand-21	white	1	5500	17/6/2015	2586	2/19/2017	No
MNG-71	Brand-22 (anticorrosive)	grey	1	6500	2/7/2016	8-6	2/19/2017	No
MNG-70	Brand-23 (anticorrosive)	white	1	7500	none	none	2/19/2017	Yes
MNG-73	Brand-24 (anticorrosive)	yellow	1	7500	3/13	none	2/19/2017	Yes
MNG-43	Brand-25	yellow	1	6500	30/11/2016	700001667	2/19/2017	Yes
MNG-45	Brand-25	red	1	6500	9/8/2014	700001498	2/19/2017	Yes
MNG-50	Brand-25	white	1	6500	none	none	2/19/2017	Yes

TABLE 3. RESULTS OF LABORATORY ANALYSIS OF SOLVENT-BASED PAINTS FOR HOME USE.

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Country of Brand Headquarters	Country of Manufacture	Is there information on can about lead content of paint?
MNG-77	Brand-01	red	1,800	China	China	No
MNG-30	Brand-01	yellow	71,000	China	China	No
MNG-82	Brand-01	white	130	China	China	No
MNG-49	Brand-02	red	990	China	China	No
MNG-58	Brand-02	yellow	34,000	China	China	No
MNG-62	Brand-02	white	Below 60	China	China	No
MNG-76	Brand-03	brown	440	Russia	Russia	No
MNG-54	Brand-04	red	1,400	Russia	Russia	No
MNG-44	Brand-04	yellow	1,600	Russia	Russia	No
MNG-46	Brand-04	white	100	Russia	Russia	No
MNG-20	Brand-05	red	390	Russia	Russia	No
MNG-09	Brand-05	yellow	11,000	Russia	Russia	No
MNG-25	Brand-05	white	1,600	Russia	Russia	No
MNG-05	Brand-06	white	Below 60	Korea	Korea	No
MNG-01	Brand-06	yellow	13,000	Korea	Korea	No
MNG-78	Brand-07	yellow	27,000	China	China	No
MNG-79	Brand-07	red	2,100	China	China	No
MNG-13	Brand-07	white	1,500	China	China	No
MNG-74	Brand-08	white	70	China	China	No
MNG-55	Brand-08	yellow	24,000	China	China	No
MNG-53	Brand-08	red	Below 60	China	China	No
MNG-83	Brand-08	orange	31,000	China	China	No
MNG-02	Brand-09	white	Below 60	China	China	No
MNG-42	Brand-10	red	2,000	Russia	Russia	No
MNG-18	Brand-10	white	240	Russia	Russia	No
MNG-15	Brand-10	yellow	Below 60	Russia	Russia	No

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Country of Brand Headquarters	Country of Manufacture	Is there information on can about lead content of paint?
MNG-29	Brand-11	white	800	Russia	Russia	No
MNG-59	Brand-11	orange	390	Russia	Russia	No
MNG-75	Brand-11	yellow	290	Russia	Russia	No
MNG-38	Brand-11	green	80	Russia	Russia	No
MNG-12	Brand-12	yellow	36,000	China	China	No
MNG-16	Brand-13	white	Below 60	China	China	No
MNG-84	Brand-13	red	530	China	China	No
MNG-51	Brand-14	yellow	31,000	China	China	No
MNG-64	Brand-14	red	Below 60	China	China	No
MNG-04	Brand-14	white	Below 60	China	China	No
MNG-39	Brand-15	red	7,900	China	China	No
MNG-26	Brand-15	yellow	47,000	China	China	No
MNG-52	Brand-15	white	Below 60	China	China	No
MNG-40	Brand-16	white	240	Korea	Korea	No
MNG-65	Brand-16	red	120	Korea	Korea	No
MNG-85	Brand-16	orange	70	Korea	Korea	No
MNG-63	Brand-17	red	67,000	Germany	Germany	Yes. "Lead is harmful to health"
MNG-69	Brand-18	white	Below 60	Finland	Russia	No
MNG-68	Brand-19	white	580	Russia	Russia	No
MNG-27	Brand-20	white	360	Russia	Russia	No
MNG-17	Brand-20	red	880	Russia	Russia	No
MNG-06	Brand-20	yellow	2,000	Russia	Russia	No
MNG-03	Brand-20	green	2,700	Russia	Russia	No
MNG-61	Brand-21	white	Below 60	Ukraine	Russia	No
MNG-71	Brand-22 (anticorrosive)	grey	Below 60	Russia	Russia	No
MNG-70	Brand-23 (anticorrosive)	white	Below 60	Russia	Russia	No

Sample No.	Brand	Color	Lead Content, Dry Weight (ppm)	Country of Brand Headquarters	Country of Manufacture	Is there information on can about lead content of paint?
MNG-73	Brand-24 (anticorrosive)	yellow	Below 70	Russia	Russia	No
MNG-43	Brand-25	yellow	1,200	Russia	Russia	No
MNG-45	Brand-25	red	2,800	Russia	Russia	No
MNG-50	Brand-25	white	3,400	Russia	Russia	No

TABLE 4. 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)
Brand-01	3	3	1	130	71,000
Brand-02	3	2	1	< 60	34,000
Brand-03	1 (brown)	1	0	440	440
Brand-04	3	3	0	100	1,600
Brand-05	3	3	1	390	11,000
Brand-06	2	1	1	< 60	13,000
Brand-07	3	3	1	1,500	27,000
Brand-08	4	2	2	< 60	31,000
Brand-09	1 (white)	0	0	< 60	< 60
Brand-10	3	2	0	< 60	2,000
Brand-11	4	3	0	80	800
Brand-12	1 (yellow)	1	1	36,000	36,000
Brand-13	2	1	0	< 60	530
Brand-14	3	1	1	< 60	31,000
Brand-15	3	2	1	< 60	47,000
Brand-16	3	2	0	70	240
Brand-17	1 (red)	1	1	67,000	67,000
Brand-18	1 (white)	0	0	< 60	< 60
Brand-19	1 (white)	1	0	580	580
Brand-20	4	4	0	360	2,700
Brand-21	1 (white)	0	0	< 60	< 60
Brand-22	1 (grey)	0	0	< 60	< 60
Brand-23	1 (white)	0	0	< 60	< 60
Brand-24	1 (yellow)	0	0	< 70	< 70
Brand-25	3	3	0	1,200	3,400

TABLE 5. 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	20	10	0	< 60	3,400
Yellow	15	13	9	< 60	71,000
Red	14	12	1	< 60	67,000
Orange	3	2	1	70	31,000
Green	2	1	0	80	2,700
Brown	1	1	0	440	440
Grey	1	0	0	< 60	< 60

www.ipen.org

ipen@ipen.org

@ToxicsFree