



ASIA REGIONAL PAINT REPORT



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a toxics-free future



IPEN is a leading global organization working to establish and implement safe chemicals policies and practices that protect human health and the environment around the world. IPEN's mission is a toxics-free future for all.

IPEN brings together leading public interest groups working on environmental and public health issues in developing countries and countries in transition. It 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.

IPEN's global network is comprised of more than 700 public-interest non-governmental organizations in 116 countries. Working in the international policy arena and in developing countries, with international offices in the US and in Sweden, IPEN is coordinated via eight IPEN Regional Offices in Africa, Asia & the Pacific, Central/Eastern Europe, Latin America & the Caribbean, and the Middle East.

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FOREWORD

This report presents the results from a recent study of the lead content of oil-based enamel decorative paints available on the market in seven Asian countries.

Studies conducted between 2006 and 2011 have repeatedly shown that many paints with high lead content have been widely available on the market in these countries. However, the number of paints analyzed in previous studies has been limited, and, in some cases, focused primarily on large, multinational paint manufacturers.

The current study was undertaken with an aim to:

- Increase information about the lead content of oil-based enamel decorative paints available on the market in Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka and Thailand, especially paints made by small and medium sized paint manufacturers (SMEs)
- Assess whether or not the availability of paints with high lead content has changed since previous studies

Included in the report is background information on why the use of household paints with high lead content 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, sale and use of leaded household paints; and recommendations for taking action to protect children and others from lead in paint.

The study was conducted as a part of the Asian Lead Paint Elimination Project. The Asian Lead Paint Elimination Project has been established to eliminate lead in paint and raise widespread awareness among business entrepreneurs and consumers about the adverse human health impacts of lead-based decorative paints, particularly on the health of children under six years old. The Asian Lead Paint Elimination Project is being implemented by IPEN over a period of three years in seven countries (Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka, and Thailand) with funding from the European Union (EU) totaling €1.4 million. While this publication has been produced with the assistance of the EU, the contents of the publication are the sole responsibility of IPEN, and can in no way be taken to reflect the views of the EU.

IPEN is an international NGO network of health and environmental organizations from all regions of the world in which organizations from each of the seven countries participate. 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.

The European Union is made up of 27 Member States who have decided to gradually link together their know-how, resources and destinies. Together, during a period of enlargement of 50 years, they have built a zone of stability, democracy and sustainable development, while maintaining cultural diversity, tolerance and individual freedom. The EU is committed to sharing its achievements and its values with countries and people beyond its borders.



This brightly colored day care center in Indonesia very probably was covered with paints containing high levels of lead.

EXECUTIVE SUMMARY

From November 2012 to February 2013, a total of 803 cans of oil-based, enamel decorative paints were purchased at paint retailers in Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka and Thailand. Samples prepared from the paints were analyzed by a certified laboratory in Italy. The results are summarized in the table below.

Most of the paints analyzed contained high levels of lead

More than three-quarters (76%) of all 803 paints analyzed contained lead at concentrations greater than 90 ppm, and would not be permitted for sale in most highly industrialized countries. A third of all 803 paints analyzed contained lead at levels lower than 600 ppm, and would be permitted for sale in only a few countries where the currently existing legislation limiting the use of lead in decorative paints is less restrictive.

Many paints contained very high levels of lead

At least a quarter of the paints from all countries contained dangerously high lead levels, above 10,000. In addition, one or more of the colored paints from each country contained lead at extreme levels of 95,000 ppm or more.

Brightly colored paints contain much higher levels of lead than white paints

Lead content of the paints was shown to vary greatly depending on color, and brightly colored paints such as red, yellow and green generally contained much higher levels of lead than white paints. In several countries the average lead content was more than ten times higher for the colored paints when compared to the average of the white paints.

Some market-leading brands have removed lead from their paint production

In previous studies, many market-leading brands in the seven countries were shown to have used leaded raw materials in their paint production. However, in this study all the paints analyzed from some of these brands now contain lead below 90 ppm.

Equivalent lead-free paints are available

Paints with undetectable levels of lead were easily available on the market in all countries, at retail prices in a similar price range as the lead-containing paints.

Consumer information is lacking on paint cans

Few paints included a list of the ingredients of the paint on the label. None of the cans containing leaded paints stated this on the label, or contained any kind of warning about the hazard of lead and creating lead dust through disturbance of surfaces coated with lead paint.

Third party verification is needed

Labels on a total of 95 paint cans included claims from the manufacturer of being lead-free. However, 17 of these still contained levels of lead of more than 90 ppm, ranging from 230 ppm to 56,000 ppm lead. It is clear that third-party verification is needed in order to establish the trustworthiness of such claims.

RECOMMENDATIONS

Government and government agencies

- Fast track the approval of a strong regulation that will ban the manufacture, importation, exportation, distribution, sale and use of household paint products with total lead content (dry weight) above the maximum limit of 90 ppm
- Establish monitoring programs along with strong enforcement measures to ensure paint companies are in compliance with the 90 ppm standard
- Provide incentives to paint companies to swiftly transition from lead to non-lead paint production
- Require standard paint container labeling on lead content and lead dust hazards
- Source only unleaded paints for interiors of public buildings, schools, day care centers, and facilities frequented by children such as parks, playgrounds and health care facilities
- Make information available on the negative impact of the lead exposure through health channels

Paint Industry

- Discontinue the use of lead-based pigments, driers, and substances used for other purposes in paint formulations, and shift to non-hazardous substitutes
- Commit to an expedited switch to producing paint products with lead content below 90 ppm, starting with enamel decorative paints
- Implement measures to safeguard industry workers and painters from lead exposure

- Commit to a third-party certification and labeling program to ensure that all paints sold in the market meet the proposed regulatory standard of 90 ppm and help the customer distinguish between paints that are safe and those that are not

Consumers

- Ask for unleaded paints for safer homes and patronize businesses that sell unleaded paints; large consumers should specify in their purchase orders that only non-leaded paints be used
- Read the label before purchasing any paint and ask about lead content

Public Health Organizations

- Support policy measures that will eliminate childhood lead exposure from all sources
- Join in efforts to inform the public about childhood and occupational health risks linked with lead paints and lead dust

All Stakeholders

- Support policy measures that will eliminate childhood lead exposure from all sources
- Join in efforts to inform the public about childhood health and occupational health risks linked with lead paints and lead dust

SUMMARY OF RESULTS FROM THE PAINT STUDY

Country		Number of Paints	Number of Brands	Average Lead Concentration (ppm)	Percent Greater Than 90 ppm (Number)
Bangladesh	Total	90	34	11,900	71% (64)
	White paints	30		3,330	63% (19)
	Colored paints	60		16,200	75% (45)
India	Total	250	147	22,800	90% (224)
	White paints	115		4,000	86% (99)
	Colored paints	135		38,800	93% (125)
Indonesia	Total	78	43	17,300	77% (60)
	White paints	32		2,580	72% (23)
	Colored paints	46		27,500	80% (37)
Nepal	Total	49	21	16,600	71% (35)
	White paints	19		1,440	63%(12)
	Colored paints	30		26,200	77%(23)
Philippines	Total	122	34	18,500	61% (75)
	White paints	33		455	30% (10)
	Colored paints	89		25,200	73% (65)
Sri Lanka	Total	94	57	11,600	63% (59)
	White paints	32		2,260	44% (14)
	Colored paints	62		16,300	73% (45)
Thailand	Total	120	68	19,100	79% (95)
	White paints	52		1,840	62% (32)
	Colored paints	68		32,300	93% (63)

Percent Greater Than 600 ppm (Number)	Percent Greater Than 10,000 ppm (Number)	Min Lead Content (ppm)	Max Lead Content (ppm)
64% (58)	28% (25)	<8	123,000
57% (17)	10% (3)	<8	23,000
68% (41)	37% (22)	<8	123,000
83% (207)	44% (111)	<8	160,000
74% (85)	6% (7)	<8	52,000
90% (122)	77% (104)	<8	160,000
62% (48)	33% (26)	<12	116,000
53% (17)	0% (0)	12	10,000
67% (31)	57% (26)	<12	116,000
65% (32)	29% (14)	<9	130,000
53% (10)	0% (0)	11	6,100
73% (22)	47% (14)	<9	130,000
52% (63)	39% (48)	<8	156,000
18% (6)	0% (0)	<8	4,700
64% (57)	54% (48)	<8	156,000
50% (47)	24% (23)	<6	131,000
31% (10)	3% (1)	<9	39,000
60% (37)	35% (22)	<6	131,000
69% (83)	40% (48)	<9	95,000
46% (24)	0% (0)	<9	9,500
87% (59)	71% (48)	26	95,000

BACKGROUND TO LEAD PAINT

The term “decorative paint” as used in this report 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.

The amount of lead in a paint is often defined as the total parts per million (ppm) by its dry weight. IPEN recommends 90 ppm as an achievable and protective goal for lead in paint worldwide, which is the current standard for household paints in the U.S. and Canada and would ensure that a manufacturer could sell its paint anywhere in the world.

SOURCES OF LEAD IN DECORATIVE PAINT

Paints contain high levels of lead when the paint manufacturer intentionally adds one or more lead-containing compound to the paint for some purpose. A paint product may also contain some amount of lead when the paint ingredients used are contaminated with lead, or when there is cross contamination from other product lines in the same factory.

The lead 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 compounds commonly used as paint pigments include: lead chromates, lead oxides, lead molybdates and lead sulfates. Lead-based pigments are sometimes used alone and sometimes used in combination with other pigments.

Lead compounds also may be added to enamel (oil-based) paints for use as driers (sometimes called drying agents or catalysts). Enamel paints dry to a hard and smooth surface through a process that involves chemical reactions in which paint ingredients called binders polymerize and crosslink. The driers serve as catalysts that speed up the polymerization and make paints dry faster and more evenly. Lead compounds commonly used as driers include lead octoate and lead naphthene. These lead-based driers are generally not used alone, but are usually combined with other driers, including compounds of manganese, cobalt and others.

ALTERNATIVES TO LEAD IN PAINT

Highly industrialized countries in North America, Western Europe and elsewhere have strictly controlled the lead content of all decorative paints sold and used in their countries for decades. They have also controlled the lead content of paints

used on children's toys and for other applications likely to contribute to childhood lead exposure. Even in the absence of specific laws and regulations, some paint manufacturers in most developing countries and countries with economies in transition are already producing unleaded paints and compete well in the marketplace.

Non-leaded pigments and driers have been widely available for decades and are now used by manufacturers producing the highest quality paints. In most cases, by avoiding the use of lead pigments, lead driers and other intentionally added lead compounds, a paint manufacturer will produce paints that have lead content well below 90 ppm and that can be sold competitively in any country in the world.

If a case arises in which a paint product has been analyzed and found to contain somewhat more than 90 ppm lead, but the paint manufacturer claims to have eliminated the use of all intentionally added lead compounds, the source of the lead might be significant impurities or lead contamination in one or more of the paint ingredients. A paint manufacturer can easily avoid using highly contaminated ingredients by using appropriate quality control procedures, and informing suppliers that paint ingredients with high lead contamination are not acceptable.

The cost to manufacturers associated with reformulating decorative paints to avoid the use of added lead compounds appears to be minimal. Although studies in the public literature on the costs to paint manufacturers in developing countries associated with discontinuing the use of added lead compounds in the paints they manufacture are lacking, NGO staff and consultants working on lead paint elimination projects have had personal conversations in several countries with paint



Lead Paint Terminology

As used in this booklet, the term ***“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.

The term ***“enamel”*** refers to oil-based paints.

The term ***“ppm”*** means parts per million total lead by weight in the dried paint sample.

manufacturers who have recently reformulated their paints. Most or all continued to sell their paints at the same price points after reformulation. For smaller manufacturers, the biggest challenge often appears to be the time and effort associated with establishing the quantities and formula needed for producing the lead-free paint, and identifying an appropriate and reliable vendor willing and able to provide the substitute ingredients and advice on their proper use.

LEAD EXPOSURE AND ITS HEALTH EFFECTS

Children are generally not exposed to lead from paint while the paint is still in the can or when the paint is being newly applied to a previously unpainted or uncoated surface. Rather, lead exposure generally occurs after the lead paint has already dried on the wall or on the article that has been painted.

Over time, paint on a surface will chip, wear and deteriorate. This happens more quickly when the surface is exposed to sunlight and humidity or is subject to friction and impact (such as with windows and doors). Any lead that was present in the deteriorating paint is released to dust and soil in and around the home, school or other location where lead paint was used. When a surface that was previously painted with lead paint is sanded or scraped in preparation for repainting, very large amounts of lead-contaminated dust is produced and spread. Special training is needed to learn how to contain the lead dust that is created and to remove it safely and effectively from the home, school or other locations.

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 house dust or the soil is contaminated with lead, the children 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 approximately 100 milligrams of house dust and soil each day (WHO, 2010).

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 chips can be much higher than what is typically found in dust and soils. When toys, household furniture or other articles are painted with lead paint, children may chew on them and directly ingest the lead-contaminated dried paint. Nonetheless, the most common way that children ingest lead is through lead-contaminated dust and soil that gets onto their hands.

While lead exposure is also harmful to adults, lead exposure harms children at much lower doses, 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 (WHO, 2012). 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.



Children in the Philippines carry posters calling for the elimination of lead in paints.

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

It is generally agreed that one key element in lead toxicity is its capacity to replace calcium in neurotransmitter systems, proteins and the bone structure, altering their function and structure and thereby leading to severe health impacts. Lead is also known to affect and damage the cell structure (Verstraeten *et al.*, 2008).

Children are more sensitive to the harmful effects of lead than adults for several reasons including:

- A child's brain undergoes very rapid growth, development and differentiation and lead interferes with this process. For example, it has been shown that moderate lead exposure (5 to 40 µg/dL) during early childhood is connected to region-specific reductions in adult gray matter volume. Moderate blood levels have been linked to an increased likelihood of impaired cognition and executive function, impulsiveness, aggression and delinquent behavior. The loss of grey matter in the brain constitutes a potential explanation for cognitive and behavioral problems associated with lead exposure (Cecil *et al.*,

2008). Brain damage caused by chronic, low-level exposure to lead is irreversible and untreatable.

- Exposure to lead early in life can re-program genes, which can lead to altered gene expression and an associated increased risk of disease later in life. For example, gene alterations caused by prenatal lead exposure have been implicated in the development of Alzheimer's disease (Mazumdar *et al.*, 2012).
- Gastrointestinal absorption of lead is enhanced in childhood. Up to 50 percent of ingested lead is absorbed by children, as compared with 10 percent in adults. Pregnant women may also absorb more ingested lead than other adults (WHO, 2010).

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 (Prüss-Üstün and Corvalán, 2006).

In recent years, medical researchers have been documenting significant health impacts in children from lower and lower lead exposures (Needleman, 2004; Lanphear *et al.*, 2005). In response, the U.S. Centers for Disease Control and Prevention (CDC) and other authorities have concluded that there are no safe blood lead levels for children (CDC, 2013).

ECONOMIC IMPACTS

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 (Mielke and Zahran, 2012). This impact continues throughout life, has a long-term impact on the child's work performance, and — on average — causes decreased economic success as measured by life-long earnings. Widespread lead exposure harms society as a whole by placing an extra burden on the national education system; raising national costs associated with increased crime and incarceration rates; and reducing the overall national productivity of labor.

A recent study that investigated 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 dollars¹ per year (Attina

THE ECONOMIC BURDEN OF CHILDHOOD LEAD EXPOSURE IN ASIA IS ESTIMATED AT NEARLY **\$700 BILLION.**

and Trasande, 2013). 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:

1 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.

Africa: \$134.7 billion of economic loss or 4.03% of Gross Domestic Product (GDP)

Latin America and the Caribbean: \$142.3 billion of economic loss or 2.04% of Gross Domestic Product (GDP)

Asia: \$699.9 billion of economic loss or 1.88% of Gross Domestic Product (GDP)

Looking only at the countries included in this study, the economic burden of childhood lead exposure estimated was:

Bangladesh: \$15.9 billion of economic loss or 5.9% of Gross Domestic Product (GDP)

India: \$236 billion of economic loss or 5.2% of Gross Domestic Product (GDP)

Indonesia: \$37.9 billion of economic loss or 3.4% of Gross Domestic Product (GDP)

Nepal: \$1.53 billion of economic loss or 4.0% of Gross Domestic Product (GDP)

Philippines: \$15.0 billion of economic loss or 3.8% of Gross Domestic Product (GDP)

Sri Lanka: \$1.76 billion of economic loss or 1.5% of Gross Domestic Product (GDP)

Thailand: \$12.5 billion of economic loss or 2.1% of Gross Domestic Product (GDP)

THE ASIAN PAINT MARKET

From 2002 to 2007, the global coatings market grew by over 30%. Since 2007, however, the market has contracted. One exception is the Asia Pacific region which has dramatically outperformed the global market in both volume and value growth. From 2004 to 2009, the Asia Pacific coatings segment grew by 60% in volume and value. Due to this growth, the Asia Pacific region has become the largest market for paint and coatings in the world (Detiveaux and Tasaur, 2011).

The Asia Pacific region is now estimated to represent approximately 35% of the nearly \$90 billion global value of all coatings and 41% of the 27 billion liter global coatings volume, and it is projected to grow above the global average in coming years.

Decorative coatings comprise approximately 35% of the Asian Pacific market compared to 50% of the global market (Detiveaux and Tasaur, 2011).

High growth countries are China, India, Indonesia, Vietnam, Malaysia, Philippines and Thailand (Detiveaux and Tasaur, 2011), yet a number of other countries also report high growth. One of fastest growing markets in the world is Indonesia, which grew 13% from 2011 to 2012 after an average annual growth of 8% between 2006 and 2011 (BaliFokus, 2013). And in Nepal, paint sales have been increasing at an annual rate of 35% (Subedi, 2012). Analysts also expect decorative paint markets in India, Bangladesh and the Philippines to grow significantly in the coming years.

POLICY FRAMEWORKS FOR ELIMINATING LEAD PAINT

An international convention limiting the use of white lead in interior paints was adopted by the General Conference of the International Labour Organization as early as 1921 and ratified by 63 countries. Many highly industrial countries enacted additional laws, regulations or mandatory standards to protect the health of their people in the 1970s and 1980s.

The European Union has completely prohibited the use of lead carbonates and lead sulphates for use in decorative paint. In addition, use of lead chromates is severely restricted with a complete ban coming into force in 2015. The standard adopted by the United States imposes an upper limit of 90 ppm on total lead (dry weight) for decorative paints, and Canada has a similar limit. In Argentina, Brazil, Chile, and Uruguay, recent decrees with the force of law have established a maximum allowable lead concentration in enamel decorative paints of 600 ppm.

IN MOST CASES, BY AVOIDING THE USE OF LEAD PIGMENTS, LEAD DRIERS AND OTHER INTENTIONALLY ADDED LEAD COMPOUNDS, A PAINT MANUFACTURER WILL PRODUCE PAINTS THAT HAVE LEAD CONTENT WELL BELOW 90 PPM AND THAT CAN BE SOLD IN ANY COUNTRY IN THE WORLD.

Paint studies from Africa, South America and Asia show that in countries where no national law, binding regulation, or other legal instrument specifically forbids it, some or most of the brands of enamel decorative paints for sale on the national market contain high levels of lead (Clark et al., 2009; Kumar, 2009; University of Cincinnati, 2013; UNEP, 2013). However, two countries with mandatory limits were shown to have some paints with high lead concentrations. This suggests that national laws, binding regulations, or other legal instruments are key tools for controlling the lead content of decorative paints but they must have effective enforcement provisions to be useful.

Limiting the use of lead in decorative paint may also be aided by voluntary schemes such as third-party paint certification and labeling programs. Under such programs, participating paint companies agree that they will not add lead com-

pounds to their paints and only market products with lead levels below a specified limit (for example, 90 ppm). Participating companies also agree to place a certification label on their paints indicating that the paint does not contain added lead compounds. Consumer groups and others then work cooperatively with participating companies to encourage consumers to look for the label when selecting paints. Third party monitors have the paints analyzed on a regular basis to ensure compliance.

INTERNATIONAL FRAMEWORK FOR LEAD PAINT ELIMINATION: GLOBAL ALLIANCE TO ELIMINATE LEAD PAINT (GAELP)

At the second session of the International Conference on Chemicals Management (ICCM), held in 2009, several chemical issues were identified by consensus to be international priority issues of concern. One of these issues was lead in paint, and there followed a decision to establish lead in paint as an international emerging policy issue (SAICM, 2009). In response to the ICCM decision, the United Nations Environment Programme (UNEP) and the World Health Organization (WHO) jointly initiated a global partnership to eliminate the use of lead compounds in paints in order to protect public health and the environment. This partnership is called the Global Alliance to Eliminate Lead Paint (GAELP). GAELP's broad objective is to phase out the manufacture and sale of paints containing lead and eventually to eliminate the risks from such paint.²

ASIAN POLICY FRAMEWORKS FOR LEAD PAINT ELIMINATION

A few countries in Asia regulate the allowed lead content in decorative paints. China limits lead content to 90 ppm of soluble lead in the paint. Singapore has a limit of 600 ppm of total lead content (dry weight). However, paints with lead concentrations exceeding these limits have been found repeatedly in studies of lead levels in newly produced paints in both countries (Clark et al., 2006; Clark et al., 2009; Lin et al., 2009). In these studies, the occurrence of paints with high lead content seems to be more frequent in China than Singapore; hence the regulation in China seems not to be as effective as the regulation in Singapore.

The most recent legislation was put into place in the Philippines in December 2013, where the Department of Environment and Natural Resources (DENR) issued a Chemical Control Order (CCO) prohibiting lead levels in decorative paint above 90 ppm.

2 More information about GAELP can be found at UNEP's web page: <http://www.unep.org/hazardoussubstances/LeadCadmium/PrioritiesforAction/GAELP/GAELPObjectives/tabid/6331/Default.aspx>

Of the seven countries included in the study, only Sri Lanka had a mandatory standard in place at the time this study was conducted. This standard, which came into force on January 1, 2013 while paint purchases were being made, limited the legal lead content in decorative enamel paints to 600 ppm.

Thailand has a voluntary standard issued by the Thai Industrial Standard Institute (TISI) limiting the lead content of decorative paints to 100 ppm.

In India, the Bureau of Indian Standards (BIS) has issued a voluntary standard limiting the lead content of decorative paints. At the time of this study the maximum lead content was limited to 1,000 ppm, but it was revised to 90 ppm in early 2014.

MATERIALS AND METHODS

From November 2012 to February 2013, partner NGOs in each of the seven Asian countries — with help and support from IPEN — purchased a total of 803 cans of oil-based, enamel decorative paint.

All paints were purchased from paint stores in local markets and communities, hardware stores, building supply stores and larger retail establishments used by the general public. In other words, paints purchased were presumed to be intended for home use. Excluded were automotive and industrial paints that are not typically used for domestic housing applications or to paint toys or household articles. However, if there was an indication on the paint can that one of the suggested uses for this type of paint was household-related, it was then eligible to be included.

The paints represented a total of 404 paint brands, and from each brand a white and a brightly colored paint was selected for purchase. These colors were chosen because recent studies of decorative paints for sale in developing countries have found that, in general, white paints have the lowest lead concentrations and brightly colored paints contain the highest lead concentrations. This is explained by the fact that white lead-based pigments are now very rarely used because an alternative white pigment, titanium dioxide, is inexpensive, has superior properties and has been in use in many countries for many decades.

Added lead compounds are rarely used in water-based paints. Any lead content found in a sample of a water-based paint is almost always very low and is the likely result of a lead-contaminated ingredient, not an intentionally added lead compound. Therefore, only oil-based paints and no water-based decorative paints were selected.

Paint sample preparation kits containing individually numbered, untreated wood pieces, single-use brushes and stirring utensils made from untreated wood sticks were assembled and shipped to IPEN partner NGOs in each of the Asia countries by staff at Arnika, IPEN's NGO partner in the Czech Republic. Each paint was thoroughly stirred in the can and applied by a separate, unused, single-use brush to duplicate, individual, numbered, unused, wood pieces by staff of each Asian partner NGO.

Each stirring utensil and paintbrush was used only once, and care was taken to avoid cross contamination. After drying, the wood pieces were placed in individual plastic bags and shipped for analysis of lead content to Certottica laboratory in Italy.



A technician paints a test stick with a lead enamel paint. Note that the breathing mask protects her from volatile organic compounds rather than lead exposure.

Certottica is accredited by ACCREDIA — the Italian Accreditation System, which is the Italian National Accreditation Body appointed by the State. This laboratory participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program operated by the American Industrial Hygiene Association under a program established by the US Environmental Protection Agency.

Paint was scraped off the wood pieces at the lab, and the paint was weighed into a hot block digestion tube. The paint chips were then digested according to method CPSC-CH-E1003-09.1 (United States Consumer Product Safety Commission Directorate for Laboratory Sciences, 2011). Lead in the digestates was analyzed by an Atomic emission spectrophotometer (ICP-AES), Thermo Scientific iCAP 6000 Series, using yttrium (2 mg/L) as internal standard.

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, for 100

mg of paint scraped off the wood pieces, 8 ppm is the lowest detection limit, but for a smaller amount of paint the detection limit increases.

OVERALL STUDY RESULTS

A total of 803 cans of enamel decorative paints were purchased in retail establishments in the following seven countries: Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka and Thailand.

TABLE 1: SUMMARY OF RESULTS OF THE ANALYZED PAINTS

Country	Number of Paints	Number of Brands	Average Lead Concentration (ppm)	Percent Greater Than 90 ppm (Number)	Percent Greater Than 600 ppm (Number)	Percent Greater Than 10,000 ppm (Number)	Minimum ppm	Maximum ppm
Bangladesh	90	34	11,900	71% (64)	64% (58)	28% (25)	<8	123,000
India	250	147	22,800	90% (224)	83% (207)	44% (111)	<8	160,000
Indonesia	78	43	17,300	77% (60)	62% (48)	33% (26)	<12	116,000
Nepal	49	21	16,600	71% (35)	65% (32)	29% (14)	<9	130,000
Philippines	122	34	18,500	61% (75)	52% (63)	39% (48)	<8	156,000
Sri Lanka	94	57	11,600	63% (59)	50% (47)	24% (23)	<6	131,000
Thailand	120	68	19,100	79% (95)	69% (83)	40% (48)	<9	95,000
All samples	803	404	18,000	76% (612)	67% (538)	37% (295)	<6	160,000

Most of the paints analyzed would not meet regulatory standards established in most highly industrial countries

More than three-quarters (76%) of all 803 paints analyzed contained lead at concentrations greater than 90 ppm, and would not be permitted for sale in most highly industrialized countries. A third of all 803 paints analyzed contained lead at levels lower than 600 ppm, and would be permitted for sale in only a few countries where the currently existing legislation limiting the use of lead in decorative paints is less restrictive.

Paints with extremely high levels of lead are still available in most countries.

In all the countries, a high proportion of the paints analyzed had a concentration of lead higher than 10,000 ppm, ranging from 24% to 44% of all paints analyzed.

In six of the seven countries, one or more of the analyzed paints contained lead levels of 100,000 ppm lead or greater, i.e. 10% of the dry weigh of the paint or more.

LEAD CONCENTRATIONS IN PAINTS BY COLOR

When available, both a white and a brightly colored paint were analyzed from each brand. The first selection of bright color was yellow, red and orange, but also some other colors, such as blue and green, were chosen if the first choice was not available. In some cases, several bright colors from the same brand were analyzed. Of the 803 paints analyzed, 313 (39%) were white and 490 (61%) brightly colored (Tables 2, 3).

TABLE 2: LEAD CONTENT OF WHITE PAINTS

Country	Number of Paints	Average Lead Concentration ppm	Percent Greater Than 90 ppm	Percent Greater Than 600 ppm	Percent Greater Than 10,000 ppm	Minimum ppm	Maximum ppm
Bangladesh	30	3,330	63% (19)	57% (17)	10% (3)	<8	23,000
India	115	4,000	86% (99)	74% (85)	6% (7)	<8	52,000
Indonesia	32	2,580	72% (23)	53% (17)	0% (0)	12	10,000
Nepal	19	1,440	63%(12)	53% (10)	0% (0)	11	6,100
Philippines	33	455	30% (10)	18% (6)	0% (0)	<8	4,700
Sri Lanka	32	2,260	44% (14)	31% (10)	3% (1)	<9	39,000
Thailand	52	1,840	62% (32)	46% (24)	0% (0)	<9	9,500
Total	313	2,700	67% (209)	54% (169)	4% (11)	<8	52,000

White Paints contained the lowest amount of lead

Of all the 313 white paints analyzed, 67% contained lead at levels greater than 90 ppm, 54% contained lead at levels greater than 600 ppm and 4% had levels

greater than 10,000 ppm. The average lead concentration in all of the white paints was 2,700 ppm.

With the exception of a very low average in the Philippines of 455 ppm lead, the averages for the white paints analyzed in each country are very similar. As can be seen by the highest lead level detected, lead can still be found in white paints at very high levels in most of the countries. However, the low frequency of white paints containing very high levels of lead (>10,000 ppm) supports the hypothesis that white lead pigments are now rarely used in enamel decorative paints in these countries due to the superior properties of the lead-free alternatives. The high frequency of white paints with a lead content greater than 600 ppm suggests that lead-based driers are still used in many enamel decorative paints in all of the seven countries.

TABLE 3: LEAD CONTENT OF COLORED PAINTS

Country	Number of Paints	Average Lead Concentration ppm	Percent Greater Than 90 ppm	Percent Greater Than 600 ppm	Percent Greater Than 10,000 ppm	Minimum ppm	Maximum ppm
Bangladesh	60	16,200	75% (45)	68% (41)	37% (22)	<8	123,000
India	135	38,800	93% (125)	90% (122)	77% (104)	<8	160,000
Indonesia	46	27,500	80% (37)	67% (31)	57% (26)	<12	116,000
Nepal	30	26,200	77%(23)	73% (22)	47% (14)	<9	130,000
Philippines	89	25,200	73% (65)	64% (57)	54% (48)	<8	156,000
Sri Lanka	62	16,300	73% (45)	60% (37)	35% (22)	<6	131,000
Thailand	68	32,300	93% (63)	87% (59)	71% (48)	26	95,000
Total	490	28,000	82% (403)	75% (369)	58% (284)	<8	160,000

Yellow, red and other brightly colored paints had the highest lead concentrations

The average lead concentration of all the colored paints was 28,000 ppm, more than ten times higher than the average for all the white paints. 82% of the analyzed paints had a lead concentration greater than 90 ppm, 75% were above 600 ppm, and 58% were above 10,000 ppm.

One or more of the colored paints from each country contained lead at extreme levels of 95,000 ppm or more. At the same time, brightly colored paints with a lead content of well below 90 ppm were easily available in all countries.

The above findings are consistent with studies from other countries (Clark *et al.*, 2009), in which white enamel decorative paints had a much lower lead content on average compared to brightly colored paints. The findings are also consistent with the hypothesis that leaded pigments are still used in many brightly colored paints in the seven countries included in the study.

PRICE DIFFERENCES BETWEEN PAINTS WITH HIGH AND LOW LEAD CONTENT

Information about the price per liter of the paints analyzed was collected from six of the seven countries (Table 4). The price per liter was calculated based on the price and size of the can. As prices between small cans and large cans sometimes differ in corresponding price per liter, the bias potentially introduced by comparing paint cans of different sizes was reduced by grouping the cans into size categories (i.e. below 0.5 L and between 0.51 L-1.0 L), and only prices of paints within the same category were compared.

Only small differences in retail prices were seen when the average prices of white and colored paints, with and without high lead content, were compared. In several cases, the average price for the paints with low lead content was lower than the average price for the paint with high lead content. Although the average price of paints with low lead levels were in some cases higher, the actual increase in average price amounted to only a maximum of 1.41 Euro per liter.

TABLE 4: AVERAGE PRICE OF WHITE PAINTS

Country	Low lead content (<90 ppm)	High lead content (>90 ppm)	Price difference between paints with low and high lead content, local currency (EUR/USD)	Price difference (% of price of low lead paints compared to high lead paints)
Bangladesh	372 BDT	385 BDT	-13 (-0.12/-0.16)	97%
India	324 INR	354 INR	-30 (-0.35/-0.48)	92%
Indonesia	44423 IDR	49822 IDR	-5399 (-0.34/-0.46)	89%
Philippines	238 PHP	313 PHP	-75 (-1.23/-1.68)	76%
Sri Lanka	1018 LKR	981 LKR	37 (0.21/0.28)	104%
Thailand	170 THB	145 THB	24 (0.55/0.75)	117%

TABLE 5: AVERAGE PRICE OF COLORED PAINTS

	Low lead content (<90 ppm)	High lead content (>90 ppm)	Price difference between paints with low and high lead content, local currency (EUR/USD)	Price difference (% of price of low lead paints compared to high lead paints)
Bangladesh	304 BDT	434 BDT	-130 (-1.22/-1.66)	70%
India	332 INR	306 INR	26 (0.31/0.42)	109%
Indonesia	58330 IDR	43884 IDR	14446 (0.91/1.24)	133%
Philippines	277 PHP	276 PHP	0.2 (0.00)	100%
Sri Lanka	829 LKR	915 LKR	-86 (-0.48/-0.66)	91%
Thailand	224 THB	161 THB	63 (1.41/1.93)	139%

CONSUMER INFORMATION ON PAINT CAN LABELS

Very few of the paints included in the study detailed the ingredients of the paint on the label and none warned about the hazards of disturbing surfaces previously painted with lead paint. None of the countries have legislation requiring that this type of information be provided to consumers.

Labels on some paints in all countries (a total of 95 paints all together) made claims of “no lead added,” “lead-free” or similar claims. In all countries, except for Thailand, these claims were proven to be accurate. However, 17 of the 29 Thai paints claiming to be lead-free contained levels of lead ranging from 230 ppm to 56,000 ppm. None of the cans indicated that the paint manufacturer participated in an independent, third party certification scheme to ensure the accuracy of the claims.

LEADING PAINT BRANDS

This is the largest study undertaken in the Asia region on the lead content of enamel decorative paints.

In the South Asia region, several studies conducted between 2006 and 2011 analyzed paint samples primarily from the five manufacturers with the largest market share in Bangladesh, India, Nepal and Sri Lanka (Kumar, 2009; Toxics Link, 2011). In these studies, four of these manufacturers were shown to produce paints with high levels of lead. However, more recent studies show a decline in the use of lead in their paints over the last couple of years.

The situation in the other countries included in this study from Southeast Asia is more disparate. The large manufacturers in the Philippines mostly produce lead-free paints and the largest paint company in Indonesia only produces lead-free paint. However, large companies in Thailand still produce paints with high lead content.

The positive trend in many of these countries towards lead-free paint production since the first study on lead in enamel decorative paints was released in 2006 suggests that public awareness of lead in paint can help drive market change.



A large array of paints were collected and analyzed in this study.

LEAD CONCENTRATIONS IN PAINTS BY COUNTRY

Lead was detected in enamel decorative paints at very high levels ($> 10,000$ ppm) in 37% of all of the analyzed paints included in this study (295 of the 803 paints), and a majority of paints sampled could not be sold in industrialized countries.

Although a large number of paints included in this study contain high levels of lead, this does not take the market share of the paint manufacturers into account. As many paint manufacturers that hold a large part of the market share have gradually reduced and removed lead from their enamel, decorative paints during the last couple of years, the data suggests that in many countries much of the remaining problem resides with the small and medium sized manufacturers.

BANGLADESH

Though the averages were still high, colored paints from Bangladesh had among the lowest average (16,200 ppm) lead content compared to the other countries, as well as among the lowest occurrence of colored paints with a lead content above 10,000 ppm (37%). Still, the maximum concentration of lead detected in the paints was 123,000 ppm. Five leading paint brands, taken together, have almost 90% of the market share in Bangladesh. All paints included in this study from two of them, Berger Paints and Asian Paint, contained low levels of lead.

INDONESIA

None of the white paints from Indonesia contained lead above 10,000 ppm. However, more than half of the colored paints contained lead at levels higher than 10,000 ppm, as reflected by the high average of 27,500 ppm for the colored paints. These results indicate the use of leaded pigments in paints with bright colors but not in white paints. Sales from five major paint brands constitute almost 75% of the paint market. However, only ICI was shown to produce all paints with low levels of lead.

INDIA

At the time of the study, the voluntary standard limiting the lead content of enamel decorative paints was set to 1,000 ppm. Since then, the standard has been revised to 90 ppm. Still, 80% of all the paints analyzed exceeded 1,000 ppm. The average lead content of colored paints was 38,800 ppm, and 77% of the colored paints contained very high lead levels (>10,000 ppm).

Major paint manufacturers comprise almost 64% of the market share of paint in India. The lead concentration in all paints produced by the 5 major paint manufacturers (Asian Paint, Kansai Nerolac, Berger Paints, ICI /Akzo Nobel and Shalimar Paints) included in this study was all less than 90 ppm.

NEPAL

The white paints from Nepal contained among the lowest average amount of lead, 1,440 ppm, and among the lowest maximum concentration in white paints, 6,100 ppm. Still, almost half of the colored paints contained lead at levels greater than 10,000 ppm, the average lead concentration in the colored paints was 26,200 ppm and the maximum concentration detected was 130,000 ppm. These results indicate the use of leaded pigments in paints with bright colors but not in white paints.

Four paint companies completely dominate the Nepalese paint market, with at least 90% market share. Of these, all the paints included in this study produced by Asian Paints and Berger Jenson & Nicholson contained only low levels of lead.

PHILIPPINES

The white paints from the Philippines contained much lower concentrations of lead than the white paints from the other countries. The average lead concentration in white paints was 455 ppm, none of the paints contained lead at levels greater than 10,000 ppm, and the maximum concentration detected was 4,700 ppm. Still, more than half of the colored paints contained lead at levels greater than 10,000 ppm, the average lead concentration in the colored paints was 25,200 ppm, and the maximum concentration detected 156,000 ppm. These results indicate the use of leaded pigments in paints with bright colors but not in white paints.

Two large paint companies have an estimated combined market share of about 80% of the Philippine market. Most paint samples from these companies, the Pacific Paint (Boysen) Philippines, Inc. and Davies Philippines, Inc., were shown to contain low or non-detectable levels of lead.

SRI LANKA

Legislation limiting the lead content of household paints to 600 ppm came into force in Sri Lanka on the first of January 2013, halfway through the study period. The legislation refers to both the manufacture and sale of paints, and 64 of the 94 analyzed paints were purchased in January - February 2013 to assess whether implementation of the legislation had been successful. Of the paints purchased in 2012, 50% contained lead levels below 600 ppm, but 55% of the paints purchased after the legislation still contained lead levels greater than 600 ppm.

However, colored paints from Sri Lanka did contain among the lowest average amounts of lead, 16,300 ppm, and Sri Lanka had the lowest frequency of paints with a lead content greater than 10,000 ppm (35%).

Seven paint companies together have 80% of the paint market in Sri Lanka. Of these, all the paints included in this study from ICI (Dulux/Glidden), Lankem (Robbialac/Rolac), Causeway (Kenlux) and Macksons Lanka (Multilac/Micron) contained low levels of lead. The market share of all companies still producing paint with high levels of lead (>90 ppm) is around 10%.

THAILAND

Thailand has a voluntary limit of lead in enamel decorative paints of 100 ppm. Still, 71% of all colored paints from Thailand contained lead at levels greater than 10,000 ppm, one of the highest frequencies in the study. None of the white paints contained lead at levels greater than 10,000 ppm, and the maximum concentration detected was 9,500 ppm. These results indicate the use of leaded pigments in paints with bright colors but not in white paints.

Six paint companies together hold about 90% of the Thai paint market. Of these, all paints included in the study from Akzo-Nobel Paint (Thailand) and Jotun (Thailand) contained levels of lead below 100 ppm. Together, these two companies hold around 25% of the market.

CONCLUSIONS AND RECOMMENDATIONS

Paints containing high levels of lead were still widely available in 2013 on the market in Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka and Thailand. More than half of the paints purchased in Sri Lanka after January 1, 2013 had lead content greater than 600 ppm, despite new legislation restricting the production and sale of paints with a lead content above this level. In India and Thailand, more than 70% of the colored, decorative paints contained lead levels greater than 10,000 ppm, despite a voluntary limit of 1,000 ppm and 100 ppm lead respectively.

None of the cans containing paint with high lead concentrations had labeling disclosing lead content or warning about the hazards of lead. Self-made claims made by paint manufacturers of paints being lead-free were shown not to always be accurate. In most cases, consumers had no way of distinguishing between paints with high and low lead contents.

New legislation has recently been established in the Philippines, and efforts to enforce the legislation in Sri Lanka are being made. However, to date, no legislation exists that limits the use of lead in decorative paints in Bangladesh, India, Indonesia, Nepal, or Thailand.

RECOMMENDATIONS

Government and government agencies

- Fast track the approval of a strong regulation that will ban the manufacture, importation, exportation, distribution, sale and use of household paint products with total lead content (dry weight) above the maximum limit of 90 ppm
- Establish monitoring programs along with strong enforcement measures to ensure paint companies are in compliance with the 90 ppm standard
- Provide incentives to paint companies to swiftly transition from lead to non-lead paint production
- Require standard paint container labeling on lead content and lead dust hazards

- Source only unleaded paints for interiors of public buildings, schools, day care centers, and facilities frequented by children such as parks, playgrounds and health care facilities
- Make information available on the negative impact of the lead exposure through health channels

Paint Industry

- Discontinue the use of lead-based pigments, driers, and substances used for other purposes in paint formulations, and shift to non-hazardous substitutes
- Commit to an expedited switch to producing paint products with lead content below 90 ppm, starting with enamel decorative paints
- Implement measures to safeguard industry workers and painters from lead exposure
- Commit to a third-party certification and labeling program to ensure that all paints sold in the market meet the proposed regulatory standard of 90 ppm and to help the customer distinguish between paints that are safe and those that are not

Consumers

- Ask for unleaded paints for safer homes and patronize businesses that sell unleaded paints; large consumers should specify in their purchase orders that only non-lead paints be used
- Read the label before purchasing any paint and ask about lead content

Public Health Organizations

- Support policy measures that will eliminate childhood lead exposure from all sources
- Join in efforts to inform the public about childhood health and occupational health risks linked with lead paints and lead dust

All Stakeholders

- Support policy measures that will eliminate childhood lead exposure from all sources
- Join in efforts to inform the public about childhood health and occupational health risks linked with lead paints and lead dust

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