NATIONAL REPORT

ON

LEAD IN NEW ENAMEL HOUSEHOLD PAINTS OF BANGLADESH

ESDO

Environment and Social Development Organization

IPEN

a toxics-free future

National Report
On
Lead in New Enamel Household Paints of Bangladesh

Editorial Team:
Dr. Scott Clark, Professor Emeritus; Dr. Shahriar Hossain,
Dr. Sara Brosche, Ms. Valerie Denney

Research Team:
Ms. Siddika Sultana, Mr. K. M. Shahriar Nazrul, Ms. Emma Jacobs

Produced as part of the Asian Lead Paint Elimination Project
Supported by the European Union's SWITCH Asia Programme

Disclaimer

"While this publication has been produced with the assistance of the European Union, the contents of the publication are the sole responsibility of Environment and Social Development Organization-ESDO together with IPEN and can in no way be taken to reflect the views of the European Union. In addition, this document was produced with financial contributions from the Swedish Environment Protection Agency, Swedish public development co-operation aid through the Swedish Society for Nature Conservation (SSNC). The views herein shall not necessarily be taken to reflect the official opinion of any of these donors, including SSNC or its donors."

Printed on unbleached paper with vegetable based ink

Layout: Emma Jacobs & Valerie Denney I Photo: Dr. Shahriar Hossain
Printed by: Mordent Printers, Dhaka, Bangladesh

Environmental and Social Development Organization (ESDO) is a partner organization of the Asia Lead Paint Elimination Project, a project of IPEN.

IPEN is an international organization promoting safe chemical policies and practices that protect human health and the environment.

This project is funded by the European Union. Delegation of the European Union. The European Commission is the EU's executive body.

National Report
On
Lead in New Enamel Household Paints of Bangladesh

Acknowledgment

We acknowledge the cooperation of Bangladesh Paint Manufacturers Association (BPMA), individual paint company and retailers who provided the information of the paint market of Bangladesh.

We acknowledge the European Union for providing fund for the effort of lead paint elimination in Bangladesh, along with this study. We also acknowledge the Swedish Environment Protection Agency, Swedish public development co-operation aid through the Swedish Society for Nature Conservation (SSNC), for providing financial contribution for conducting this study.

We also acknowledge IPEN project team; Mr. Bjorn Beeler, Mr. Jack Weinberg, Ms. Jennifer Federico, Mr. Martin Salmonsson for their contribution in preparation of this report. Acknowledgement also goes to ESDO team; Ms. Sarah Jabeen Kristy, Ms. Rifat Nowshin Mayukh, Mr. Kawsar Uddin Maruf, Mr. Mamun-ul Hasan, Mr. Ali Hossain for their help in numerous ways to collect paint samples and preparing for testing.

Abbreviations

BPMA	Bangladesh Paint Manufacturers Association
CDC	Centres for Disease Control and Prevention
DoE	Department of Environment
DPHE	Department of Public Health Engineering
ESDO	Environment and Social Development Organization
ETP	Effluent Treatment Plant
EU	European Union
GAELP	Global Alliance for Eliminating Lead Paint
ICCM	International Conference on Chemicals Management
IPEN	International POPs Elimination Network
MNCs	Multi-National Corporations
ppm	parts per million
SAICM	Strategic Approach for International Chemicals Management
SMEs	Small and Medium Enterprises
UNEP	United Nations Environment Programme
WHO	World Health Organization

Contents

List of Figures

List of Tables

Foreword

This report presents detailed findings from the most extensive survey of lead content in new enamel decorative paints sold in Bangladesh ever undertaken.

In this report, we present new data on the content of household paints for sale on the Bangladesh market. We compare those results with results from two previous studies. We also present data on the paint industry in Bangladesh and multi-national and local companies producing paint.

The report was prepared by ESDO with support and assistance from the IPEN Asia Lead Paint Elimination Project. The IPEN Asia 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 European Union, the contents of the publication are the sole responsibility of ESDO together with IPEN, and can in no way be taken to reflect the views of the European Union. In addition, this document was produced with financial contributions from the Swedish Environment Protection Agency, Swedish public development co-operation aid through the Swedish Society for Nature Conservation, SSNC. The views herein shall not necessarily be taken to reflect the official opinion of any of these donors, including SSNC or its donors.

ESDO is a non-governmental organization working on environmental and health issues with various stakeholders, to create a toxic free Bangladesh and sustainable living environment. ESDO is a Participating Organization of IPEN.

IPEN is an international NGO network of health and environmental organizations from all regions of the world in which ESDO participates. 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 28 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 freedoms. The European Union is committed to sharing its achievements and its values with countries and peoples beyond its borders

Shahriar Hossain, Ph.D.
Secretary General
Environment and Social Development Organization

Dhaka, 25 October 2013

Executive Summary

In recent years the paint industry of Bangladesh has experienced unparalleled growth. There are a total of 51 large, medium and small sized companies selling paint in Bangladesh. Of these, 45 companies manufacture paint within Bangladesh and 6 import paint.

In 2012-13, the Bangladeshi NGO, Environment and Social Development Organization (ESDO) purchased 90 cans of oil-based (enamel) household paints representing 34 brands from the stores of the two largest cities (Dhaka and Chittagong) of Bangladesh and sent samples of the paints to a lab in Italy to be analyzed for lead content. This was the largest sampling of lead in paint ever undertaken in Bangladesh, and it expands on the work undertaken in the study of 2010-11.

This report has reflected ESDO's two and half year's vigorous intervention, motivation and awareness among the paint manufacturers of Bangladesh. It has also reflected the commitment and cooperation of Bangladesh Paint Manufacturers Association (BPMA) to reduce lead concentration in their paints.

Impacts of Lead on Children

Children, particularly those aged under 6, are more vulnerable to the toxic effects of lead exposure. The primary route of exposure is through ingestion of lead-contaminated dust derived from deteriorated leaded paint. In addition, some children exhibit pica (the abnormal ingestion of non-food items) and if they ingest paint chips containing lead that exposure can put them at a greater risk.

The World Health Organization (WHO) reported in 2010[1] that lead paint was one of the major sources of lead exposure for children and has identified mental retardation due to lead exposure as one of the top preventable diseases.

Study Results

Almost two thirds (64%) of paints sampled had a lead concentration above 600 parts per million (ppm) of the dry weight of the sample and would not be permitted for sale or use in most highly industrialized countries. The highest concentration detected was 123,000 ppm, over 1,300 times the recommended limit of 90 ppm.

Overall, 26 paints (29%) contained low levels of lead less than 90 ppm and meet the standard set by US. For five brands, all paints analyzed were found to have lead content below 90 ppm, this included 2 local manufacturers. All three Multinational Companies (MNCs) were found to have no paints with lead levels that exceeded 90 ppm. This is a significant reduction in lead exposure of MNCs as the previous 2010-11 study identified these companies having some of the highest lead concentrations.

The average lead concentration for paints from Small and Medium Enterprise (SMEs) was 13,200 ppm and 93% of local manufacturers included in the study sold paints that exceeded the recommended 90 ppm limit.

Yellow was found to be the most likely color of paint of those tested to contain high lead levels, with 68% of the yellow color paints containing lead concentrations above 10,000 ppm. The paint with the highest overall lead concentration was also a yellow color.

[1] WHO (2010) *Childhood Lead Poisoning*, see: http://www.who.int/ceh/publications/childhoodpoisoning/en/

Introduction and Background to the Lead Paint Issue

Lead is a toxic metal that purely causes harmful effects in biological systems. Many older homes have indoor or outdoor surfaces coated with lead-based paint. White lead, or lead (II) carbonate ($PbCO_3$), is a typical example, and was once widely used to paint wooden surfaces in homes. Other lead compounds, like vivid yellow lead chromate (PbCrO4), are used as colored pigments. As well as giving the paint its tint, lead pigments are highly opaque, so that a relatively small amount of the compound can cover a large area. White lead is very insoluble in water, making the paint highly water-resistant with a durable, washable finish.

Lead carbonate can also neutralize the acidic decomposition products of some of the oils that make up the paint, so the coating stays tough, yet flexible and crack-resistant for a longer period of time. When the lead containing paint deteriorates, lead enters into the dust, which collects on floors and other surfaces. Children touch the dust, and then put their fingers in their mouths and, in this way, ingest lead. In addition, children can be exposed to lead by directly ingesting paint, since the sweet taste of some lead paint can encourage babies and toddlers to lick or suck windowsills, crib bars, and other objects that may be coated with lead paint.

Lead containing dust from paint can be a particularly big problem during remodeling, when surfaces painted with lead paint scraped or sanded. This activity releases a large amount of lead dust, which can become a health hazard for the whole family, and particularly the children. There are many tips for safe remodeling, which guide the use of sanders, scrapers, heat guns, how to keep children and pets out of work areas, and how to clean up afterwards. If the lead paint cannot be removed in a safe way, the best option is to repaint that surface with unleaded paint.

In recent studies[2] enamel paints (sometimes called oil based paints) have been found to have higher lead concentrations than water based paints (sometimes called acrylic paints). For this reason, the current study *Lead in New Enamel Household Paints of Bangladesh,* selected to only analyze oil-based paints for lead content.

Lead is used in oil based paint for a number of purposes:

- Pigments – lead compounds are often used as pigments, in particular for bright colors such as yellow and red.
- Drying agents and catalysts – lead compounds are added to oil based paints to make them dry faster and more evenly.
- Corrosion resistance agents – lead is used in paints for metal surfaces, such as marine paints to prevent rust and corrosion. However, these paints are outside the scope of this study of household paints.
- Unintentional ingredients – trace quantities of lead are can sometimes be found as contaminants of other paint ingredients

[2] Toxic Link (2011) Double Standard: Investigating Lead (Pb) Content In Leading Enamel Paint Brands In South Asia, see: http://toxicslink.org/docs/Double_Standard_Lead_Paint_29_June_2011.pdf

Good, cost-effective substitutes for all the lead compounds that are used in making household paints have been widely available since the 1980's and before. Any paint manufacturer that currently produces household paints with added lead compounds could easily reformulate its paints using these substitutes with very little (if any) impact on the characteristics of the paints they produce or on the price.

For these reasons, ESDO and IPEN recommend 90 ppm as an achievable and protective goal for lead in paint worldwide. While international health organizations generally believe that no level of lead exposure is safe, 90 ppm is the current standard for household paints in the U.S. and Canada, and would ensure that a manufacturer can sell their paint anywhere in the world.

When a paint manufacturer does not intentionally add lead compounds in the manufacture of its paints, the lead content of the paint will be very low – almost always less than 90 parts per million (total lead, dry weight). If a paint manufacturer is careful in selecting ingredients that do not contain lead as a contaminant, the lead content of the paint will often be as low as 10 parts per million or less.

Lead Exposure to Human and Its Health Effects

Lead can be harmful to people of all ages. ESDO has been working with paint companies to reduce the lead exposure of factory staff (see Appendix 1). However exposure to lead is much more harmful for children than adults, and the health effects are generally irreversible and can have a lifelong impact[3]. The younger the child, the more harmful lead can be. Lead exposure also has severe pre-natal impacts and a pregnant woman can transfer lead from her body to that of her developing child. Recent scientific studies show that negative health effects are occurring at lower blood levels of lead than previously thought. Low-level exposure may have subtle effects on the intellectual development and behavior of infants and children.

Within the body, elemental lead can substitute for calcium, which is one of the main reasons for lead causing toxic effects. Children are particularly vulnerable to the harmful effects of lead because their growing bodies absorb lead more easily and get rid of it less efficiently than adults. Also, infants and young children are more likely to ingest lead because of their normal habit of putting things in their mouths. Lead exposure has greater health impacts for children for several reasons, including:

- Lead exposure can damage children's developing brains, causing mental retardation. Longitudinal studies have found that damage caused by chronic, low-level exposure to lead during early years is irreversible and untreatable.
- Lead exposure in young children can cause alterations in gene expression, leading to problems in later life
- Children absorb a greater proportion of lead gastrointestinal compared to adults; up to 50 percent of ingested lead is absorbed by children, as compared with 10 percent in adults. Of particular concern for developing countries, such as Bangladesh, children who suffer from nutritional deficiencies absorb an even higher proportion of ingested lead.
- The blood-brain barrier is not fully developed in children under 6, leading to a higher proportion of lead ending up in the brain in young children[4].

The World Health Organization (WHO) list's "lead caused mental retardation" as a recognized disease and one of the top ten diseases whose health burden among children is due to modifiable environmental factors[5]. In recent years, medical researchers have been documenting significant health impacts on children from lower and lower blood lead exposures[6]. In response, the U.S. Centers for Disease Control and Prevention (CDC) and other authorities have concluded that there is no known acceptable blood lead exposure level for children[7].

[3] World Health Organization, 2010. *Childhood Lead Poisoning*, p.12.

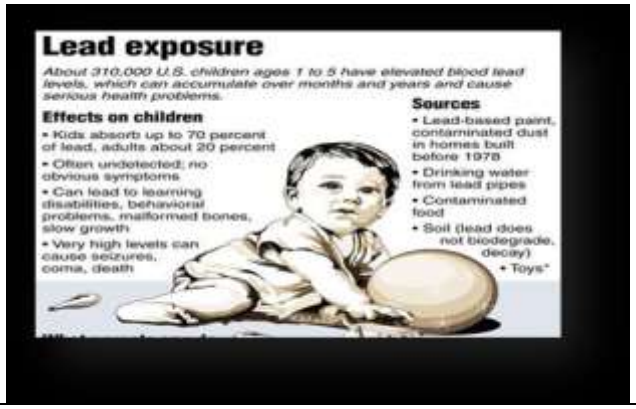
[4] Lidsky, T. and Schneider, J. 2002. Lead neurotoxicity in children: basic mechanisms and clinical correlates, *Brain: Journal of Neurology*l 126(1) p. 5-19

[5] World Health Organization, 2006. *Preventing disease through healthy environments*, p. 6. http://www.who.int/quantifying_ehimpacts/publications/preventingdisease.pdf

[6] Needleman, H., 2004. *Lead Poisoning*. Annu. Rev. Med. 55, 209–22. http://www.rachel.org/files/document/Lead_Poisoning.pdf

[7] Scientific Opinion on Lead in Food, EFSA Panel on Contaminants in the Food Chain (CONTAM), EFSA Journal 2010. http://www.efsa.europa.eu/en/efsajournal/doc/1570.pdf

Figure 1: Effect of lead on human health

Effects of Lead on Children	
Major effects on Children by Lead Poisoning 	❑ Damage to the brain and nervous system; ❑ Behavioral problems; ❑ Anemia; ❑ Liver and kidney damage; ❑ Hearing loss; ❑ Hyperactivity; ❑ Developmental delays; ❑ In extreme cases, death;

International Context

The use of lead in household paints is a matter of global concern. Bangladesh is a focal point for the national implementation of the Strategic Approach to International Chemical Management (SAICM), a global policy framework to foster sound management of chemicals. Under this framework, lead in paint was identified as one of four priority emerging policy issues at the 2nd International Conference on Chemicals Management (ICCM), held in 2009[8]. Accordingly, the United Nations Environmental 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), and it's overall goal is to prevent children's exposure to lead via paints containing lead and to minimize occupational exposures to lead in paint. GAELP's objectives are:

> *(a) To raise the awareness of government authorities and regulators, the private sector, manufacturers, consumers, workers, trade unions and health-care providers about the toxicity of lead in paints and the availability of technically superior and safer alternatives;*
>
> *(b) To catalyse the design and implementation of appropriate prevention-based programmes to reduce and eliminate risks from the use of lead in paints and products coated with lead paints;*
>
> *(c) To help identify paint manufacturers and formulators that continues to produce and market paints containing lead so as to foster actions to phase out lead from their products;*

[8] SAICM (2103) ICCM2 Outcomes and follow-up: Emerging Policy Issues, see: http://www.saicm.org/index.php?option=com_content&view=article&id=218:iccm2-outcomes-and-follow-up&catid=89:iccm-2

(d) To promote the establishment of appropriate national regulatory frameworks to stop the manufacture, import, export, sale and use of lead paints and products coated with lead paints;

(e) As appropriate, to promote international third-party certification of new paint products to help consumers to recognize paint and coatings without added lead;

(f) To share guidance and promote assistance to identify and reduce potential lead exposure in and around housing, childcare facilities and schools in which paint containing lead and paint dust is present and in industrial facilities producing or using paint containing lead to reduce workers' lead exposure.

Further commitments to the phase out of lead paint were made at the third meeting of the ICCM, held in 2012.

Bangladesh's Framework for Eliminating Lead Paint

Bangladesh currently does not have any legislation regarding the concentrations of lead in paint. *The Bangladesh conservation Act- 1995(Act)* has a very broad definition of 'hazardous substances' under which lead would be classified. The Act gives the government the power to implement standards and guidelines for the use and release of hazardous substances. However, currently there are no requirements for lead paint.

In Bangladesh, ESDO is implementing a project entitled 'IPEN Asia Lead Paint Elimination Project' along with 7 Asian partner organizations supported by the European Union. As a part of that project, ESDO arranges regular consultancy meetings with multi-national corporations (MNCs) and small and medium-size enterprises (SMEs) of paint industries in Bangladesh. The objectives of these workshops are to raise widespread awareness among MNCs and SMEs of Bangladesh paint industry about the adverse human health effects of lead-based decorative paints, particularly on the health of children. Some additional initiatives by the organization include:

- ESDO has formed alliance with the Bangladesh Paint Manufacturer Association (BPMA), Department of Public Health Engineering (DPHE) and Department of Environment (DoE).
- ESDO is conducting an ongoing signature campaign with school students and in local market places across Bangladesh, including in Dhaka, Chittagong, Hathajari and Comilla, in order to collect at least 10,000 signatures on a petition that will be submitted to the Prime Minister of Bangladesh (both online and physical).
- ESDO is running an awareness campaign on 'lead in health hazards' in both rural and urban areas.
- ESDO has produced a video clip that focuses on "harmful effects of lead on health and environment."
- ESDO organizes regular meetings with the respective Minister, Secretary and other persons to build support for a national policy to ban the use of lead in paint.

Major Paint Brands in Bangladesh

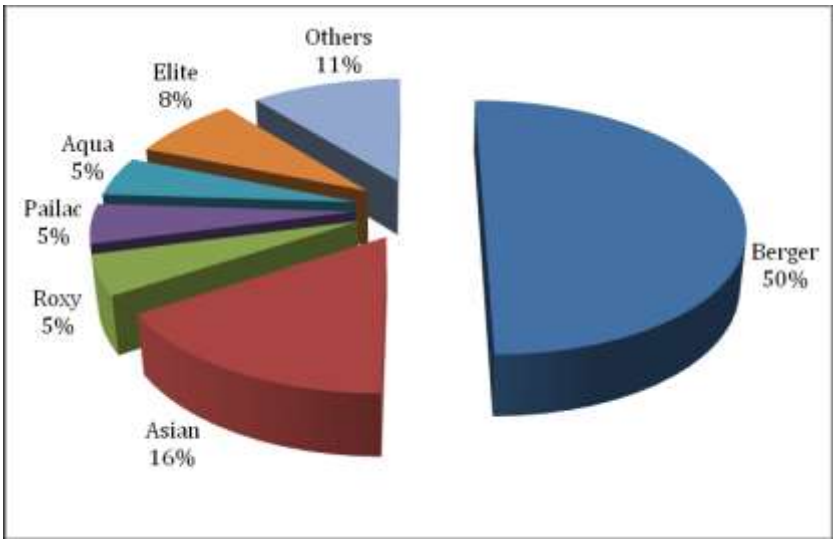


Figure 2: Major paint brands in Bangladesh (by market share)

The Bangladesh paint industry is worth about BDT 18 billion, approx 0.23 billion USD. A total of 51 large, medium and small sized companies are engaged in paint production in Bangladesh. Berger, Asian, Roxy, Pailac, Aqua, and Elite are the major players and command an almost 90% market shares (Figure 2). Berger Paints (previously known as Jenson and Nicholson in Bangladesh before 1970) alone holds 50% market share, followed by Asian Paints 16%, Roxy 5%, Pailac 5%, Aqua 5% and Elite Paints 8%. All these companies together produce 77,000 MT of paints annually, although the demand of the country is nearly 95,000 MT. According to the Ministry of Trade and Commerce Bangladesh imports about 10,000 MT of paint annually from different countries like China and Thailand and rest 8,000 MT is the deficit. The per capita paint consumption of the country is approximately 250 grams.

Materials and Methods

Between December 2012 and May 2013, the Bangladeshi NGO, ESDO, with the help and support from the international NGO network IPEN, purchased 90 cans of oil-based (enamel) house paints from stores in and around different locations of Dhaka and Chittagong. These paints were from 34 different brands. For the majority of brands, the selection was one white and two bright colors, such as shades of red and yellow. 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 or to paint toys.

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 ESDO by staff of the IPEN partner NGO, Arnika, in the Czech Republic. Each paint was thoroughly stirred in the can and applied by a separate unused single-use brush to two separate wood pieces by staff of ESDO, each numbered and previously unused. Sampling procedures are shown in Figure 3 and Appendix 2.

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.

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.

Figure 3: Photos of the sampling process

Materials for paint sampling

Each sample was stirred before sampling

Staff used a new paint brush and avoided cross contamination of the samples

Samples were left to dry before being sent to lab for testing

The laboratory scraped paint off the wood pieces they received. The paint was then weighed into a hot block digestion tube and the paint chips digested according to method CPSC-CH-E1003-09.1. A quantity of paint was removed from the sample by abrasion. The paint was placed in a beaker of borosilicate, in which were added 3 mL of HNO3 and 1 mL of 30% H_2O_2. The beaker was first covered with a glass and then was heated on a hotplate (surface temperature of approximately 140 ° C, from 85 initially to 100 ° C) until most of the acid evaporated. This treatment was repeated twice more. The beaker containing the sample was removed from the plate and let cool to room temperature. Following the watch glass was rinsed with a quantity of HNO_3 10% from 3 to 5 mL and the solution was left to hot evaporate slowly and let cool to room temperature. The cover glass was rinsed with a quantity of HNO_3 10% from 3 to 5 mL and the solution was left to evaporate slowly and let cool to room temperature. Finally, 1 mL of HNO_3 was added to the residue, which was agitated to dissolve the soluble species. The walls of the beaker and the bottom of the cover glass were rinsed and the whole was transferred into a flask and brought to volume with deionized water.

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 the lowest detection limit is 8 ppm, but for a smaller amount of paint the detection limit increases. Therefore, the lead content in three of the samples is reported as below 8 ppm, and one below 9 ppm.

Results and Discussion

Summary of Results

A total of 90 cans of new enamel decorative paint from 34 brands were purchased in Bangladesh and analyzed for total lead content. The details of the paints are listed in Appendix 3 and the complete test results are provided in Appendix 4. The sample results are expressed as parts per million (ppm), based on the dry weight of the digested sample (see Figure 4).

The average concentration of all analyzed paints was 11,900 ppm. There was a large degree of variability in the range of lead content, the standard deviation was 22,300 ppm and the median value was 2,600 ppm. The average was somewhat inflated by a small number of paints with very high concentrations. Table 1, below, shows the distribution of lead concentrations in the analyzed paints.

Table 1: Distribution of lead concentrations in analyzed paints

	All	Below 90 ppm	90-600ppm	600 - 10,000ppm	Above 10,000ppm
Number of Samples	90	26	6	33	25
Average	11,900	30	278	4,000	37,300
Standard Deviation	22,300	20	146	2,800	29,700
Median	2,600	24	250	2,900	27,900

Very high lead concentrations above 10,000 ppm were found in 25 of the 90 paints analyzed; 33 of the paints contained concentrations between 600 and 10,000 ppm, and 6 of the paints contained concentrations between 90 and 600 ppm. None of these would qualify for sale on the international market.

The other 26 paints contained low (below 90 ppm) lead concentrations. The highest concentration detected was 123,000 ppm. Figure 4, on the following page, illustrate the lead content of the analyzed paints.

Lead Concentration by Brand

The lead content in all samples from 5 paint brands were below 90 ppm. Lead concentration from 600 to10,000 ppm were found in all the analyzed samples of three other brands. Lead levels varied widely in paints from the rest of the brands. In four paints, the lead content was below the detection limit and the highest concentration was found as 123,000 ppm.

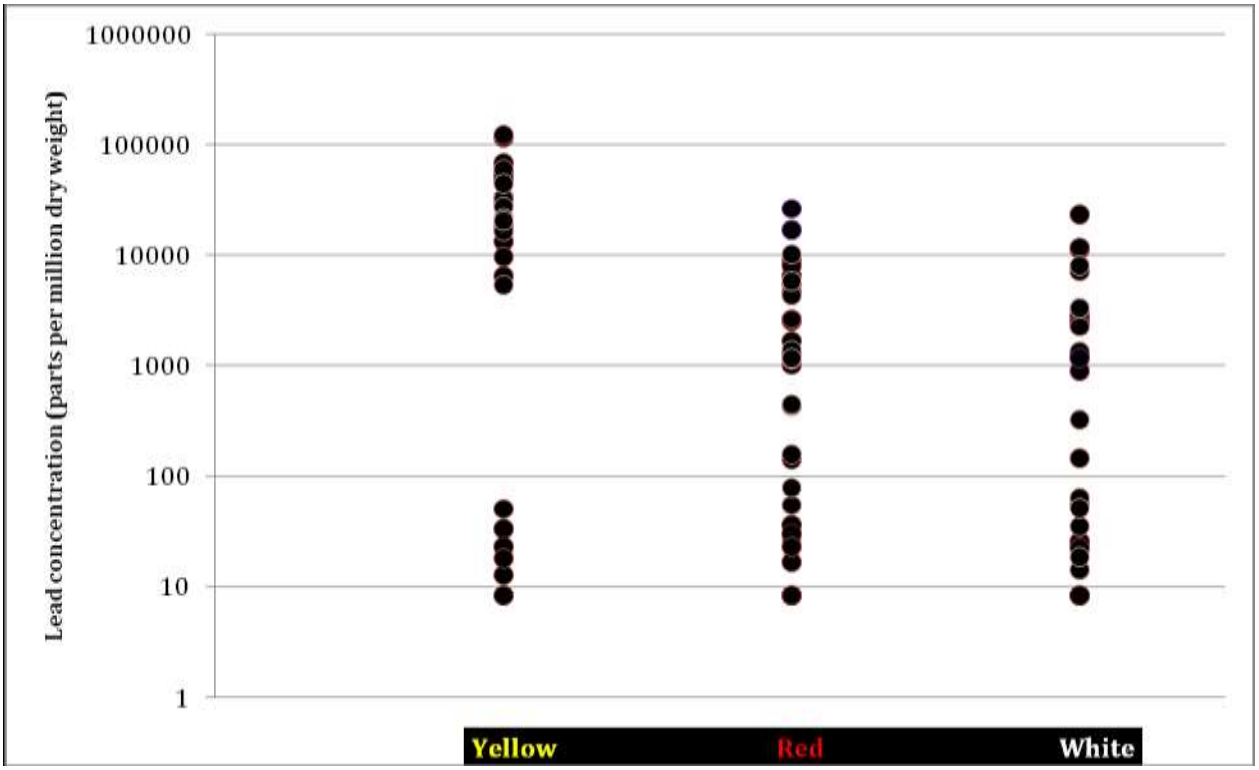


Figure 4: Lead content of the 90 analyzed paints

** Please note that there is a tenfold increase between the major ticks on the y-axis

Lead Concentration by Color

Of the analyzed paints 28 were yellow, 32 were red and 30 were white. 72% and 79% of the red and yellow paints respectively exceeded the US Standard of 90 ppm for lead in paint. A total of 79% (22 paints) of yellow paint exceeded 600 ppm, which is almost similar to some of the neighboring countries (e.g. Indonesia, Sri Lanka), while just over half the red and white exceeded 600 ppm, see Table 2 and Figure 5.

Table 2: Lead concentration by color

Lead concentration (ppm)	Yellow	Red	White
<90	21%	28%	37%
90-600	0%	13%	6%
600-10,000	11%	50%	47%
>10,000	68%	9%	10%

Two of the yellow color samples had the highest proportion of lead as 117,000 ppm and 123,000 ppm.

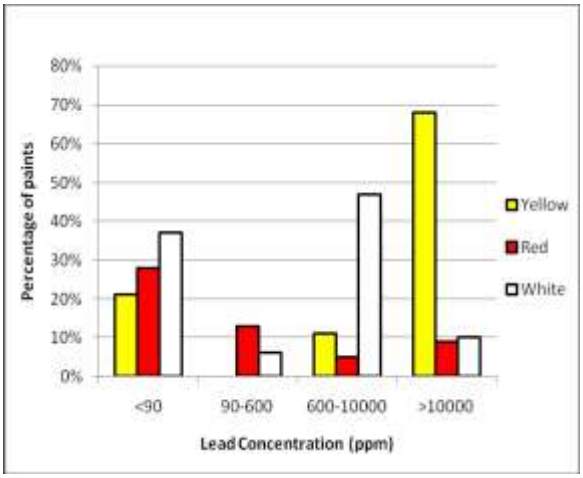


Figure 5: Lead concentration grouped by color

Scenario of MNC and SME Paints

Three Multinational companies are operating their business and production in Bangladesh. The paints analyzed for each of these companies all contained lead concentrations below 90ppm. The average lead concentration for the paints from MNCs found 20ppm.

In contrast, the average lead concentration for local SME's paints found 13,200 ppm.

Two large MNCs contributes market share of 66% (see Figure 2) therefore ESDO's intervention and motivational efforts reflects through their actions to eliminate lead paint in Bangladesh. It has created significant impact on health and environmental safety.

Table 3: Comparison of results from paint analyzes performed in 2012-13 and 2010-11

	No. Samples	% <90 ppm	% 90-600 ppm	% 600-10000 ppm	% > 10,000 ppm	Highest level detected (ppm)
2012-13	90	29	6.5	36.5	28	123,000
2010-11	6	0	0	16.5	83.5	121,900

From the Table 3, it is clear that the highest level of lead in paints in Bangladesh has increased from 121,900 ppm in 2010-11 to 123,000 ppm in 2012-13. This is true because although most of the MNCs have reduced their use of lead in paints, some SMEs are still producing paints of very high lead concentration.

However, it is also clear that companies that are market leaders in Bangladesh are gradually decreasing their use of lead. In 2010-11 one of the MNCs' produced yellow paint with a lead concentration of 121,900 ppm, whereas the results in this study shows that the same color of paint only had a lead concentration of 34 ppm. Similarly, another MNC produced yellow color paint with a lead concentration of

43,600 ppm[9] whereas the same color is now below detection limit.

The packagings for both of those MNCs' Paints include a claim about lead. One claim to be 'lead free' and other claims to have 'no added lead, mercury or chromium'. The paints analyzed from both companies all contained less than 90ppm.

It should also be noted that based on our consultation with SMEs, the easy access of lead pigment is a major barrier to reducing lead concentration in paint manufacturing. According to comments made by SMEs during our consultations, some of the MNCs are supplying lead pigment to SMEs in Bangladesh. These companies are to be commended for their efforts in recently ceasing the sale of lead paint in Bangladesh. However the sale of lead pigment for use by local SMEs is equally damaging to the children's health and safety. Further research is needed to identify lead pigment supply chains and prevent the importing of lead pigment for use by local SMEs.

There are no technical barriers to paint SMEs in Bangladesh stopping production of paints with added lead compounds. During our consultation with SMEs in Bangladesh, approximately half noted that price was a barrier to switching to lead free paint. It was also agreed that the use of lead as a drying agent was no longer needed.

The largest barrier to lead free paint production for SMEs in Bangladesh is the availability of lead free pigments. SMEs at our consultation claimed that the MNCs who supply lead pigment in Bangladesh, do not offer lead free alternatives. Making lead free pigment available in Bangladesh should be a priority, especially since the childhood health hazards associated with lead paint are very serious and well-documented.

Consumer Information

Consumers require product information to be clearly printed on the can, such as batch number, date of manufacture, date of expiration, lead dust precautions needed etc. The ability to indentify batch numbers and date of manufacture will also be a requirement for the establishment of a future certification scheme for lead free paint. However, this study found very little information on the paint containers. In some cases even weight was not denoted the same on the containers. Only 4 paints had the date of manufacture recorded and 21 provided a batch number. Therefore for the majority of paints it was not possible to identify when the product was manufactured.

[9] Toxic Link (2011) Double Standard: Investigating Lead (Pb) Content In Leading Enamel Paint Brands In South Asia, see footnote 2.

Conclusion and Recommendations

The average concentration of lead in the 90 analyzed paint samples was 11,900 ppm. This average is 132 times higher than the recommended limit of 90 ppm. As there are no safe blood lead levels in children, the high lead levels overall in the analyzed paints and the high percentage of paints with lead concentration above the recommended level of 90 ppm (71%) is quite alarming.

Five brands are producing all of the paints included in this study with lead content below 90 ppm. All samples from three brands had concentrations between 600-10,000 ppm. The other 26 brands are producing paints of varying lead concentrations.

The highest proportion of lead was found in yellow paints, and 68% of the yellow color paints contained lead concentration above 10,000 ppm. By contrast, samples from white paints contained the lowest lead levels. Only 10% of the white paints contained lead greater that 10,000 ppm and 37% contained lead below 90 ppm. These patterns of concentration by color are similar to those found in other countries[10]. While the majority of yellow paints sampled contained dangerous lead levels, the production of yellow color is also possible with lower level of lead concentration. A total of 21% of the yellow color paints contained less lead than 90 ppm. The same trend was also seen for red color paints.

As of leaded household paints are widely available in Bangladesh, children and others are being needlessly exposed to lead on painted surfaces and buildings. This will continue and increase unless action is taken to prevent future production, import, sale and use of lead paints, especially for those applications most likely to contribute to early childhood lead exposure.

Along with the growth of the middle class, the sale and use of household paints is growing rapidly in most developing countries, including Bangladesh. National action is urgently needed to eliminate the production, import, sale, and use of leaded household paints in Bangladesh as well as paints for other applications likely to contribute to childhood lead exposure. In addition, since many homes and schools have already been coated with leaded paints, initiatives are also needed to protect children and others from these legacy paints.

[10] BaliFokus (2013) National Report: Lead in Indonesia's New Enamel Household Paints, see: http://balifokus.asia/balifokus/wp-content/uploads/2013/08/210813-INA-BF-Final-Report-Revised-EN.pdf

Recommendations

For the government and relevant agencies:

- Regulate the lead content of paint imports, manufacture and sale to a maximum of 90 parts per million (ppm) total dry weight lead content.
- In addition, introduce regulations to stop the import and supply of lead pigment.
- Conduct a mass awareness campaign on the hazard of lead in paint
- Require the packaging on paint cans to alert users to the hazards of lead-contaminated dust and other materials when previously painted surfaces are scraped or sanded in preparation for repainting.
- Develop training programs for painters and others on work practices that minimize lead dust hazards.

For individual consumers as well as organizations:

- Choose lead free paints where available.
- Identify surfaces at places such as schools and childcare centers where children are likely to have high exposure to the paint and ensure lead free paint is used in these areas.
- Be aware of hazards of lead paint when renovating or re-painting and methods to avoid the hazards.

For paint manufacturers:

- Stop importing lead pigment in Bangladesh.
- Commit to phase out the use of lead in paint.
- Review workplace health and safety protocols and enforcement to prevent occupational exposure to lead.
- Develop awareness and lead safe work practice guidance that is directed towards their customers.
- Cooperate in establishing a reliable third-party certification system to ensure the paints sold in the market meets the acceptable standard of 90 ppm or less.

Knowledge Gaps and Future Work

This study has identified the increasing lead levels in paints produced by SMEs in Bangladesh. To protect the health and safety of Bangladesh's children further work is critical. Key areas for future study are:

- Identify barriers to lead free paint production for SMEs
- Map the supply chain for lead pigment and the availability of lead free pigments in Bangladesh
- Investigate factory workplace health and safety and the lead exposure of paint factory workers
- Investigate effluent treatment practices and the release of lead pigment into the environment
- Research on the use of bright colored (red and yellow) paints in Bangladesh
- Research on the use of lead paint in areas used by children, including schools, childcare facilities etc. and it products used by children, including toys, cribs and furniture.
- Introduce certified eco-labeling for lead free paint.

References

BaliFokus (2013) National Report: Lead in Indonesia's New Enamel Household Paints, see: http://balifokus.asia/balifokus/wp-content/uploads/2013/08/210813-INA-BF-Final-Report-Revised-EN.pdf

EFSA Panel on Contaminants in the Food Chain (CONTAM) (2013). Scientific opinion on lead in food. *EFSA Journal 8* (4):1570. Available on http://www.efsa.europa.eu/en/efsajournal/doc/1570.pdf. Accessed on June 1, 2013.

ESDO (2010) Lead in Paint Bangladesh Situation: Impact on Human Health and Environment

IPEN (2012) Global lead Paint elimination by 2020: a test of the effectiveness of the strategic approach to international chemicals management, see: http://ipen.org/pdfs/ipen_global_lead_paint_elimination_report_2012.pdf

Lidsky, T. and Schneider, J. 2002. Lead neurotoxicity in children: basic mechanisms and clinical correlates, *Brain: Journal of Neurologyl* 126(1) p. 5-19

Needleman, Herbert (2004). Lead Poisoning. *Annual Review of Medicine 55*, 209–22. Available on http://www.rachel.org/files/document/Lead_Poisoning.pdf. Accessed on June 2, 2013.

Scientific Opinion on Lead in Food, EFSA Panel on Contaminants in the Food Chain (CONTAM), EFSA Journal 2010.
http://www.efsa.europa.eu/en/efsajournal/doc/1570.pdf

SAICM (2103) ICCM2 Outcomes and follow-up: Emerging Policy Issues, see: http://www.saicm.org/index.php?option=com_content&view=article&id=218:iccm2-outcomes-and-follow-up&catid=89:iccm-2

Toxic Link (2011) Double Standard: Investigating Lead (Pb) Content In Leading Enamel Paint Brands In South Asia, see: http://toxicslink.org/docs/Double_Standard_Lead_Paint_29_June_2011.pdf

World Health Organization (2006). *Preventing disease through healthy environments*. Available on http://www.who.int/quantifying_ehimpacts/publications/preventingdisease.pdf

World Health Organization (2010). *Childhood Lead Poisoning*. Available on http://www.who.int/ceh/publications/leadguidance.pdf.

Appendix 1

Case Study of An Ideal SME Factory Visit

The ESDO team visited a Bangladesh SME factory in Savar, Dhaka on 18th June 2013. The factory has claimed from the very beginning that they are producing 100 % lead free paint. Objectives of the ESDO visit were to:

- Verify the factory's lead free claim
- Increase awareness among workers about the hazards of lead in paint
- Observe safety measures and health conditions
- Observe hygiene practices
- Observe the use of lead in their production

Production Process of the paints in the factory

There are total of 80 regular workers and 5 technical people in the factory. The production rate is 10,000 liters per day and target has been set either by monthly or yearly basis.

Process of using lead in paints

According to the company, driers used at these Paints are lead free, and it uses zirconium and organic pigments as an alternative to lead. The process unit for water-based paint and oil-based paint are different so that chemicals used for oil-based paints cannot affect the production process of water-based paints.

ETP – Effluent Treatment Plant

This company has taken a great deal of initiative to create a pollution free environment. It follows the rule of zero wash water discharge to the environment. It has built an effluent treatment plant (ETP) system, which separates effluent from the waste water and discharges clean water from waste water. It re-uses discharged clean water to clean colored drums, recycling the same water over and over again.

It uses lime to differentiate pigment and binder from the waste water. The pigment obtained from the ETP process is again used in the production process of paint. Moreover, by establishing this local ETP, it is ensuring that the environment is not polluted by waste discharge.

Local Waste Management Process

The company has taken some initiatives to manage the by-products and other wastes on its own. Unfortunately it burns all wastes, including plastic waste, in a large open area. It is unaware that burning waste in an open place creates open incineration, which is bad for everyone. The burning of plastics releases dioxins, which are persistent organic pollutants and have a detrimental effect of human health and the environment.

Workers Safety Measures

Workers at the factory do not follow safety measures in a proper way. Pre-production work, production work and post production work are all done with bare hands. They do not even use face masks while working.

From the visit it can be concluded that the company is doing a great job in terms of taking initiatives to reduce lead in paint (although in this study their samples contained diversified range of lead content). It still needs to take necessary steps to ensure a safe workplace for workers. The ESDO team has assured the factory that they will help it in this issue. It also needs to re-consider the open incineration of wastes which releases harmful dioxins.

Lead content of the paints

The company claims it began producing lead free paint in 2013. Three paints manufactured by this were analyzed for this report; the yellow and red samples both contained lead levels in excess of the US Standard of 90ppm (see Table 4). Unfortunately, the packaging for the paints did not provide a date of manufacture or a batch number. However, based on the date of purchase (25 February 2013), it is likely these paints were manufactured before it commenced producing lead free paint.

Table 4: Lead content level of an ideal SME paint samples

Company Type	Color of Paint	Lead Concentration (ppm)
SME	Yellow	60,000
	Red	160
	White	64

Based on the results of this sampling, it is important to note that the phasing out of lead paint may takes some time because many paint products remain on the shelf for a long time after production stops. Secondly, an independent third party certification scheme is recommended to ensure that manufacturers' claims of lead free status are supported by a robust certification, free of corruption.

Appendix 2

Different Activities of Paint Sampling Procedure

Paint cans displayed at the shop

Selection of the paint samples

Purchase of paint samples

Paint samples ready for the experiment

Wood pieces and brushes for sampling

Staff wearing safety materials

Stirring of the samples

Application of the paints to wood pieces

Drying of the painted woods

Appendix 3

Details of Enamel Decorative Paints Purchased in Bangladesh

Brand Name	Color of Paint	Paint Can Size	Date Manufactured (if given)	Batch # (if given)	Date of Purchase	Price (BDT)	Price (Euro)	Information about lead on can?
Berger	Yellow	200 ml			25-Feb-13	57	0.6	Yes; Lead free
Berger	Red	200 ml	10.12.12	1207708	25-Feb-13	57	0.6	Yes; Lead free
Berger	White	455 ml	16.07.12	1188199	25-Feb-13	152	1.59	Yes; Lead free
Asian	Yellow	455 ml		FL 104820	25-Feb-13	165	1.73	Yes; No added lead, mercury & chromium
Asian	Red	455 ml		128982	25-Feb-13	165	1.73	Yes; No added lead, mercury & chromium
Asian	White	455 ml		1211217	25-Feb-13	165	1.73	Yes; No added lead, mercury & chromium
RAK	Yellow	910 ml		RB 20388PE	25-Feb-13	250	2.62	No
RAK	Red	910 ml		RC 120636PE	25-Feb-13	250	2.62	No
RAK	White	910 ml		RE121263 PE	25-Feb-13	275	2.88	No
Pailac	Yellow	450 ml		11012	25-Feb-13	120	1.26	No
Pailac	Red	450 ml		30912	25-Feb-13	120	1.26	No
Pailac	White	200 ml		25812	25-Feb-13	60	0.63	No
Romana	Yellow	200 ml			25-Feb-13	61	0.64	No
Romana	Red	200 ml			25-Feb-13	61	0.64	No
Romana	White	200 ml			25-Feb-13	61	0.64	No
Roxy	Yellow	200 ml		B12CKR	25-Feb-13	53	0.55	No
Roxy	Red	455 ml		E03682	25-Feb-13	115	1.2	No

Brand Name	Color of Paint	Paint Can Size	Date Manufactured (if given)	Batch # (if given)	Date of Purchase	Price (BDT)	Price (Euro)	Information about lead on can?
Roxy	White	200 ml		B19BKR	25-Feb-13	53	0.55	No
Elite	Yellow	200 ml		A23101282	25-Feb-13	65	0.68	No
Elite	Red	455 ml		1610979	25-Feb-13	65	0.68	No
Elite	White	200 ml		0281162A	25-Feb-13	65	0.68	No
Paintex	Yellow	455 ml			25-Feb-13	65	0.68	No
Paintex	Red	455 ml			25-Feb-13	65	0.68	No
Paintex	White	455 ml			25-Feb-13	65	0.68	No
Al Karim	Yellow	900 ml			25-Feb-13	230	2.41	No
Al Karim	Red	900 ml			25-Feb-13	230	2.41	No
Al Karim	White	900 ml			25-Feb-13	230	2.41	No
Good luck	Yellow	200 ml			25-Feb-13	55	0.58	No
Good luck	Red	200 ml			25-Feb-13	55	0.58	No
Good luck	White	200 ml			25-Feb-13	55	0.58	No
Mayna	Yellow	230 ml			14-Mar-13	40	0.42	No
Mayna	Red	230 ml			14-Mar-13	40	0.42	No
Mayna	White	230 ml			14-Mar-13	40	0.42	No
Moon moon	Yellow	200 ml			16-Mar-13	40	0.42	No
Moon moon	Red	200 ml			16-Mar-13	40	0.42	No
Moon moon	White	200 ml			16-Mar-13	40	0.42	No
Rollic	Yellow	225 ml			16-Mar-13	60	0.63	No
Rollic	Red	225 ml			16-Mar-13	60	0.63	No
Rollic	White	225 ml			16-Mar-13	60	0.63	No
Al Hossain	Yellow	200 ml			14-Mar-13	70	0.73	No

Brand Name	Color of Paint	Paint Can Size	Date Manufactured (if given)	Batch # (if given)	Date of Purchase	Price (BDT)	Price (Euro)	Information about lead on can?
Al Hossain	Red	200 ml			14-Mar-13	70	0.73	No
Al Hossain	White	200 ml			14-Mar-13	70	0.73	No
German	Yellow	450 ml			14-Mar-13	160	1.68	No
German	Red	450 ml			14-Mar-13	160	1.68	No
German	White	450 ml			14-Mar-13	160	1.68	No
Sheezan	Yellow	200 ml			14-Mar-13	60	0.63	No
Sheezan	Red	200 ml			14-Mar-13	60	0.63	No
Sheezan	White	200 ml			14-Mar-13	60	0.63	No
Eurolac	Yellow	200 ml			14-Mar-13	65	0.68	No
Eurolac	White	200 ml			14-Mar-13	65	0.68	No
Eurolac	Red	200 ml			14-Mar-13	65	0.68	No
Monilac	Yellow	450 ml			16-Mar-13	160	1.68	No
Monilac	Red	450 ml			16-Mar-13	160	1.68	No
Monilac	White	200 ml			16-Mar-13	65	0.68	No
Moon star	Yellow	455 ml			14-Mar-13	153	1.6	No
Moon star	Red	455 ml			14-Mar-13	153	1.6	No
Moon star	White	455 ml			14-Mar-13	153	1.6	No
Sancolite	Yellow	455 ml			16-Mar-13	160	1.68	No
Sancolite	Red	455 ml			16-Mar-13	160	1.68	No
Sancolite	White	455 ml			16-Mar-13	160	1.68	No
Sunglo	Red	200 ml			14-Mar-13	65	0.68	No
Sunglo	White	200 ml			14-Mar-13	65	0.68	No
Alfa	White	455 ml			14-Mar-13	160	1.68	No

Brand Name	Color of Paint	Paint Can Size	Date Manufactured (if given)	Batch # (if given)	Date of Purchase	Price (BDT)	Price (Euro)	Information about lead on can?
Ujala	Yellow	200 ml			25-Feb-13	55	0.58	No
Ujala	Red	200 ml			25-Feb-13	55	0.58	No
Ujala	White	200 ml			25-Feb-13	55	0.58	No
Rangs	Yellow	200 ml			25-Feb-13	53	0.55	No
Rangs	Red	200 ml			25-Feb-13	53	0.55	No
Rangs	White	200 ml			25-Feb-13	53	0.55	No
Deer	Yellow	455 ml			25-Feb-13	150	1.57	No
Deer	Red	455 ml			25-Feb-13	160	1.68	No
Merilac	Red	200 ml			25-Feb-13	51	0.53	No
Merilac	White	200 ml			25-Feb-13	51	0.53	No
Aqua	Red	910 ml		1225101112	25-Feb-13	225	2.36	No
Aqua	White	910 ml		178021205	25-Feb-13	225	2.36	No
Zidan	Red	200 ml			25-Feb-13	44	0.46	No
Paramex	Yellow	455 ml			7-Apr-13	75	0.79	No
Paramex	Red	455 ml			7-Apr-13	75	0.79	No
Paramex	White	455 ml			7-Apr-13	75	0.79	No
Navana	Red	910 ml	Jan-12	23668AP	7-Apr-13	247	2.59	No
Navana	White	910 ml	Mar-13	27187CQ	7-Apr-13	275	2.88	No
Anchor	Yellow	455 ml			15-Apr-13	100	1.05	No
Anchor	Red	455 ml			15-Apr-13	100	1.05	No
Anchor	White	455 ml			15-Apr-13	100	1.05	No
Raaz	Yellow	200 ml			5-May-13	55	0.58	No
Raaz	Red	200 ml			5-May-13	55	0.58	No
Rehana	Yellow	250ml			5-May-13	70	0.73	No
Rehana	White	250ml			5-May-13	70	0.73	No
Rock	Yellow	455 ml			7-May-13	160	1.68	No
Rock	Red	455 ml			7-May-13	160	1.68	No

Appendix 4

Results of Lead in Paints Analysis Information of Bangladesh

Sample #	Concentration (mg/kg)	Color of Paint	Information about lead on can?
BGD-100	34	Yellow	Yes; Lead free
BGD-101	<8	Red	Yes; Lead free
BGD-102	<8	White	Yes; Lead free
BGD-103	<8	Yellow	Yes; No added lead, mercury & chromium
BGD-104	36	Red	Yes; No added lead, mercury & chromium
BGD-105	9	White	Yes; No added lead, mercury & chromium
BGD-106	23	Yellow	No
BGD-107	30	Red	No
BGD-108	26	White	No
BGD-109	34,000	Yellow	No
BGD-110	2,600	Red	No
BGD-111	2,900	White	No
BGD-112	47,000	Yellow	No
BGD-113	27,000	Red	No
BGD-114	7,800	White	No
BGD-115	17,400	Yellow	No
BGD-116	1,720	Red	No
BGD-117	53	White	No
BGD-118	117,000	Yellow	No
BGD-119	4,700	Red	No
BGD-120	2,600	White	No
BGD-121	69,000	Yellow	No
BGD-122	6,500	Red	No
BGD-123	11,300	White	No
BGD-124	52	Yellow	No
BGD-125	17	Red	No
BGD-126	23,000	White	No
BGD-127	13	Yellow	No
BGD-128	5,600	Red	No
BGD-129	8,200	White	No
BGD-130	56,000	Yellow	No
BGD-131	<9	Red	No
BGD-132	23	White	No

Sample #	Concentration (mg/kg)	Color of Paint	Information about lead on can?
BGD-133	6,500	Yellow	No
BGD-134	2,600	Red	No
BGD-135	2,400	White	No
BGD-136	13,600	Yellow	No
BGD-137	1,310	Red	No
BGD-138	1,220	White	No
BGD-139	53,000	Yellow	No
BGD-140	1,030	Red	No
BGD-141	910	White	No
BGD-142	28,000	Yellow	No
BGD-143	9,100	Red	No
BGD-144	11,900	White	No
BGD-145	18	Yellow	No
BGD-146	23	Red	No
BGD-147	56	White	No
BGD-148	19,800	Yellow	No
BGD-149	7,200	White	No
BGD-150	8,000	Red	No
BGD-151	9,900	Yellow	No
BGD-152	440	Red	No
BGD-153	148	White	No
BGD-154	123,000	Yellow	No
BGD-155	2,700	Red	No
BGD-156	1,360	White	No
BGD-157	29,000	Yellow	No
BGD-158	143	Red	No
BGD-159	2,300	White	No
BGD-160	56	Red	No
BGD-161	14	White	No
BGD-162	3,400	White	No
BGD-163	60,000	Yellow	No
BGD-164	160	Red	No
BGD-165	64	White	No
BGD-166	33,000	Yellow	No
BGD-167	4,400	Red	No
BGD-168	35	White	No
BGD-169	16,700	Yellow	No
BGD-170	1,120	Red	No
BGD-171	1,410	Red	No
BGD-172	330	White	No

Sample #	Concentration (mg/kg)	Color of Paint	Information about lead on can?
BGD-173	10,300	Red	No
BGD-174	19	White	No
BGD-175	1,180	Red	No
BGD-176	5,400	Yellow	No
BGD-177	440	Red	No
BGD-178	3,400	White	No
BGD-179	17,100	Red	No
BGD-180	8,000	White	No
BGD-181	45,000	Yellow	No
BGD-182	5,900	Red	No
BGD-183	1,170	White	No
BGD-184	28,000	Yellow	No
BGD-185	79	Red	No
BGD-186	22,000	Yellow	No
BGD-187	51	White	No
BGD-188	21,000	Yellow	No
BGD-189	26	Red	No

Lead Free Paint:

Healthy Children, Safe Environment

Environment and Social Development Organization (ESDO)

is a non-governmental organization working on environmental and health issues with various stakeholders, to create a toxic free Bangladesh and sustainable living environment. ESDO is a participating organization of IPEN.

IPEN

is an international organization promoting safe chemical policies and practices that protect human health and the environment.

Published by

Environment and Social Development Organization (ESDO)
House # 8/1, Block-C, Lalmatia
Dhaka-1207, Bangladesh

Tel: +880-2-912-2729
Fax:+880-2-913-0017
E-mail: info@esdo.org
Url: www.esdo.org