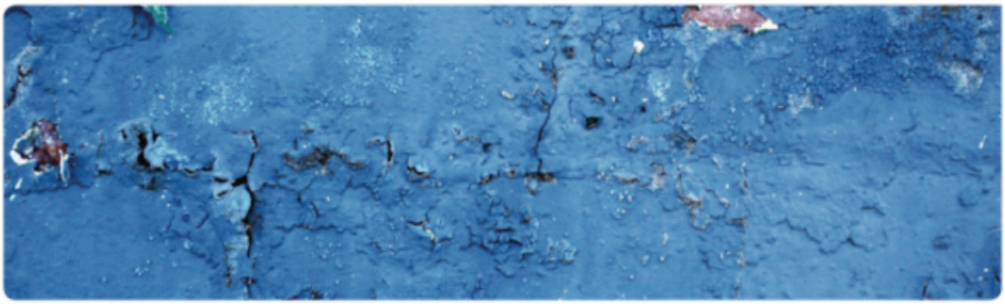
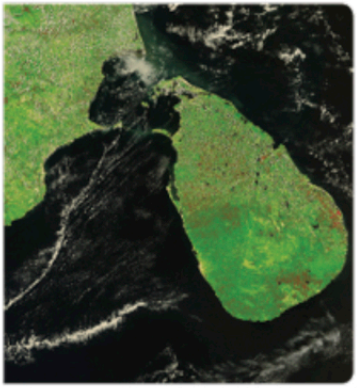


National Report

LEAD IN HOUSEHOLD DUST IN SRI LANKA



Chalani Rubesinghe, (BSc, MSc)
Dr. Sara Brosché
Valerie Denney
Dr. Scott Clark, Professor Emeritus
Jack Weinberg

June 2014

Centre for Environmental Justice

European Union

IPEN
a toxics-free future

National Report

LEAD IN HOUSEHOLD DUST IN SRI LANKA

Prepared by:
Chalani Rubesinghe, (BSc, MSc)
Dr. Sara Brosché
Valerie Denney
Dr. Scott Clark, Professor Emeritus
Jack Weinberg

National Report

LEAD IN HOUSEHOLD DUST IN SRI LANKA

June 2014

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

Layout and print : Sithru Graphics
Photos : Dilena Pathragoda, Sugath Athapaththu and Sugandika Dias

Printed on unbleached paper with vegetable based ink

CONTENTS

ACKNOWLEDGEMENTS

We would like to thank the pre-school and school teachers who generously gave their time and cooperated with us in carrying out this research study.

We would also like to thank the European Union, whose funding has made possible work to eliminate lead in paint in Sri Lanka, including this study.

Also our Thank goes to IPEN for its assistance in preparing this report and in work to eliminate lead paint in Sri Lanka. Specifically, we would like to thank Mr. Bjorn Beeler, Martin Salmonsson, and Sara Brosche.

Finally we thank the staff of CEJ for all of its hard work, including Mr. Hemantha Withanage, Mr. Dilena Pathragoda, Miss. Sugandika Dias, Mr. Sugath Athapaththu, Mrs. Shanika Lokuruge, Mrs. Kanthi Kondadeniyagedara, Mrs. Nilmal Wickramasinghe, not forgetting Miss. Rebecca Heaton, Mr. Gamini Piyarathne and all those who helped in numerous ways to bring this study a success.

FOREWORD

This report presents the results from an analysis of lead in dust at 20 locations in Sri Lanka. The locations include homes, schools and other places where children spend much time, and might be exposed to high levels of lead.

This report is the second in a series of three reports related to lead in paint in Sri Lanka prepared by Centre for Environmental Justice as part of the IPEN Asian Lead Paint Elimination Project. The first, *Lead in Sri Lankan New Enamel Household Paints*, released in 2013, showed that almost 50% of paint brands for sale in Sri Lanka, contained high levels of lead (above 600 ppm, the legal limit in Sri Lanka). A third report, due out in 2015, will follow up by analyzing paint brands found containing high levels of lead in the 2013 study, to determine whether or not paint manufacturers are beginning reduce lead levels in their paint. The first report by Centre for Environmental Justice on lead in decorative paint was released in 2009, and was the first to reveal that many decorative paints easily available on the market contained high levels of lead.

Based on the 2009 study results, CEJ went to the Supreme Court requesting a mandatory standard for the sake of the health of the children in Sri Lanka (Case No. 64/2011). As a result, the Consumer Affairs Authority made a gazette notification (Gazette Extra Ordinary No 1725/30 on 30 September 2011) establishing new mandatory standards for lead levels in paint to take effect on January 1, 2013.

Lead contaminated dust and soil is the major pathway by which lead in paint contributes to childhood lead exposure. *Lead in Household Dust in Sri Lanka* presents documented examples of the presence of lead in dust on floors of houses and schools and why the use of household paints with high lead content is a source of serious concern, especially for children's health. It also proposes recommendations for taking action to protect children and others from lead in paint.

Lead in Household Dust in Sri Lanka was prepared by Centre for Environmental Justice with support and assistance from the Asian Lead Paint Elimination Project. The Asian Lead Paint Elimination Project is a project of IPEN with EUR €1.4 million funding from the European Union. The project is being conducted over a three year period in seven countries (Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka, and Thailand). Its purpose is to eliminate lead in paint in those countries and raise widespread awareness among property owners, painters, paint companies and consumers about the adverse human health impacts of lead-based decorative paints, particularly on the health of children under six years old.

While this publication has been produced with the assistance of the European Union,

the contents of the publication are the sole responsibility of IPEN and Centre for Environmental Justice, and can in no way be taken to reflect the views of the European Union.

Centre for Environmental Justice is a participating organization in IPEN. It is a public interest environmental organization based in Sri Lanka working towards environmental justice and good governance. The science section conducts research work in the fields of chemical contamination. In addition to its research work, CEJ also communicate with general public in order to deliver the scientific knowledge in simple language, with reading materials produced on numerous issues. Handling environmental related court cases and EIA training programs are carried out by the legal section of the organization in the objective of Justice for all!

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

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 freedom. The European Union is committed to sharing its achievements and its values with countries and people beyond its borders.

June 2014
Hemantha Withanage
Executive Director
Centre for Environmental Justice

INTRODUCTION

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

Recent data collected by Centre for Environmental Justice in 2013 showed that a majority of oil-based, enamel decorative paint brands sold in Sri Lanka contained high levels of lead (above 600 parts per million, ppm) and could not be legally sold in most industrialized countries. It was found that about 50% of analyzed enamel paints contained lead levels low enough to be sold legally in Sri Lanka (<600 ppm) and a quarter of all paints (23 of 94 paints) analyzed contained dangerously high levels of lead (above 10,000 parts per million lead, dry weight). Brightly colored paints were identified to contain the highest levels of lead: all of the 6 green paints contained lead above 10 000 ppm, 16 out of 27 yellow colored paints and 12 out of 27 red colored paints contained lead levels above 600 ppm.

Of the 57 paint brands included in the study, 36 included paints with lead levels that exceeded 600 ppm. 21 brands sold paints with dangerously high lead levels above 10,000 ppm. In addition, 2 brands included paints with lead levels even exceeding 100,000 ppm.

These findings are consistent with other studies documenting the availability of lead paints in developing countries. Since 2007, NGOs associated with the IPEN network have collected and analyzed decorative paints for sale on the market in 30 developing countries and countries with economies in transition. In every one of these countries, if there was no national law or regulation in force to control the lead content of paints, the majority of the enamel decorative paints for sale on the market contained lead levels above 90 parts per million (ppm). Many of the paints contained more than 10,000 ppm lead and would be prohibited for sale or use in virtually all highly industrial countries. In almost all cases however, the consumer had no way to tell which of the enamel decorative paints for sale contained added lead and which did not.

Lead Paint Terminology

As used in this report, the term "decorative paint" refers to paints that are produced for use on inside or outside surfaces (e.g. walls, windows, doors and floors) 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" as used in this report refers to oil-based paints. The term "ppm" means parts per million total lead by weight in the dried paint sample. The lead content of dust is commonly measured in microgram lead per square feet ($\mu g/ft^2$), referring to the area from where the dust sample was taken

HOUSEHOLD DUST AND CHILDREN'S EXPOSURE TO LEAD

Children are not generally 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. However, as paint on household surfaces chips, wears and deteriorates over time, lead present in the deteriorating paint is released and contaminates surrounding surfaces. In this way, lead in the paint will end up in the household dust and soil surrounding the house. Surfaces that are subjected to a lot of wear and tear, such as wooden windows, are major sources of lead contamination in dust (Dixon, et al., 2007). Even homes with intact lead paint are known to have higher dust lead levels. Very large amounts of lead-contaminated dust can also be produced when a surface that was previously painted with lead paint is sanded or scraped in preparation for repainting or remodeling without applying proper safety measures.

Children playing indoors or outdoors get house dust or soil on their hands and then ingest it through normal hand-to-mouth behavior (Lanphear, et al., 2002, and references therein). When the dust or soil is contaminated with lead, the children ingest lead, Lead contaminated dust and soil is the major pathway by which lead in paint contributes to childhood lead exposure (Lanphear, et al., 2002; Lanphear, et al., 1998). Hand-to-mouth behavior is especially prevalent in children aged six years and under, the age group most easily harmed by exposure to lead. It is estimated that a typical one- to six-year-old child ingests approximately 110 milligrams of house dust and soil each day (US EPA, 2008).

Several studies have shown that the presence of lead paint on the interior or exterior of a home and the lead content of the household dust are both strongly linked to children´s blood lead level (Clark, et al., 1985; Gaitens, et al., 2009; Lanphear, et al., 1998). This indicates that lead paint remains a significant source of lead exposure to children for many years after it has been applied, even if the more recent coats of paint does not contain lead.

Please see Appendix 3 for additional information for how to reduce exposure to lead dust in your home.

HEALTH IMPACTS OF EXPOSURE TO LEAD

The health impacts of long-term low level lead exposure in young children are lifelong, irreversible, and untreatable. Studies conducted over the last decades have shown harmful effects of lead at lower and lower blood lead levels, and no safe blood lead level in children has been identified (Bellinger, 2008). As a result, 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 (CDC, 2013). 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).

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.

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 blood lead exposure (5 to 40 µg/dL) during early childhood is connected to region-specific reductions in adult gray matter volume (Cecil, et al., 2008).

- 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 (WHO, 2010; 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. In addition, children are more likely to have nutritional deficiencies that lead to increased absorption of lead (WHO, 2010).

COSTS OF CHILDHOOD EXPOSURE TO LEAD

Though the economic costs associated with childhood exposure to lead are substantial, they are completely avoidable. Low cost, safe, high quality alternatives to lead have been produced and used for decades in industrialized countries. Eliminating lead in paint in developing countries and countries in transition is particularly important because paint sales in most countries are growing rapidly. Failure to address this problem now will have high social and economic costs later.

REDUCED LIFELONG EARNINGS.

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 engages in impulsive and violent behavior (Mielke and Zahran, 2012). For example, it has been shown that blood lead levels as low as 2 µg/dL at an early age can cause an impact on end-of-grade tests in elementary school (Miranda, et al., 2007). 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 lifelong earnings.

HIGHER SOCIAL AND DEVELOPMENT COSTS.

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 dollars[1] per year (Attina and Trasande, 2013). Broken down by region, the economic burden of childhood lead exposure as estimated by this study was:

- 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 GDP
- Asia: $699.9 billion of economic loss or 1.88% of GDP.

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."

LEGACY CLEANUP COSTS.

Current experiences in industrial countries illustrate the significant costs that occur when lead paint is allowed to be widely used. Despite being banned in 1978, significant lead-based paint hazards still exist in over 20 million housing units in the United States (Jacobs et al. 2002). Leaded paint remains one of the primary sources of childhood lead poisoning, particularly among children living in poverty (WHO, 2010).

Removing lead paint hazards safely in the average U.S. house can cost anywhere from USD $10,000 to $45,000, a cost usually born by owners, taxpayers and/or government agencies. The cost to business can also be high. In California, three paint companies were recently required to pay the state USD $1.15 billion to abate lead paint from pre-1978 homes. Most lead-based paint hazard reduction remediation work in housing does not fully-remove the lead-based paint and requires careful maintenance of the painted surfaces to address new lead hazards as they arise.

STUDY AIM AND METHOD

This effort was undertaken to highlight the presence of high levels of lead in household dust, and the health hazard associated with high lead levels in dust. In order to be able to compare the results from the study with recommendations, previous published data, and information about hazardous levels of lead in household dust, the dust wipe method described by the U.S. Department of Housing and Urban Development (HUD) was followed (HUD, 2012). In addition, results from dust wipe analyses have been shown to correlate with children´s blood lead level (Gulson, et al., 2013). The detailed method is described in Appendix 1. A total of 2 houses, 2 schools and 16 pre- schools were sampled for this study.

RESULTS IN BRIEF

Few countries have regulatory standards limiting the maximum allowed lead content of dust. In the U.S, a surface dust lead loading from a floor area in housing or other areas used by children that contains levels equal to or higher than 40 µg/ft^2 is defined by the United States Environmental Protection Agency (US EPA) as a dust-lead hazard. However, this standard is based on the aim of keeping blood lead levels in 95% of the children exposed at or below 15 µg/dL (Gaitens, et al., 2009). This level is far higher than the 5 µg/dL the US CDC uses for identifying children in need of medical monitoring and lead exposure prevention measures.

Scientific studies performed over the last decades show that dust lead loadings as low as 10 µg/ft^2 can contribute to blood lead levels harmful to the developing brain (see e.g. Lanphear, et al., 1998; Dixon, et al., 2009). Therefore, this lead level was used as reference in the analysis of the dust results.

The results of the dust analysis are shown in Table 1. Of the 20 locations where dust samples were collected, two were private homes, two were schools and 16 were pre schools. One or more samples from 11 of the 20 locations contained lead levels exceeding 10 µg/ft^2. One or more samples from three of 20 locations contained lead at levels exceeding 40 µg/ft^2, ranging from 47 - 600 µg/ft^2. One or more sample from 8 of the locations contained lead levels between 10-39 µg/ft^2. Lead levels were below detection (8 µg/ft^2) in all samples from nine of the locations (Figure 1).

The majority of the locations sampled were schools and preschools with brightly colored paint on the walls, on the furniture, the playground equipment or other areas of the school. One or more samples from half of these locations contained lead above 10 µg/ft^2. In addition, one or more samples from three of these locations contained levels of lead above 40 µg/ft^2, and the maximum lead loading detected (600 µg/ft^2) was at a school. It is clear that special care needs to be taken to make sure that the paints used in and around schools and childcare facilities is not a source of lead exposure to children.

Of the two private home locations sampled, one was part of a housing scheme. One or more samples from both locations contained levels of lead above 10 µg/ft^2. However, in the housing scheme high levels of lead was only found in the dust from the common area, and the dust from the house adjacent contained levels of lead below detection (8 µg/ft^2). This implies that having a cleaner housing environment can help to prevent dust lead hazards.

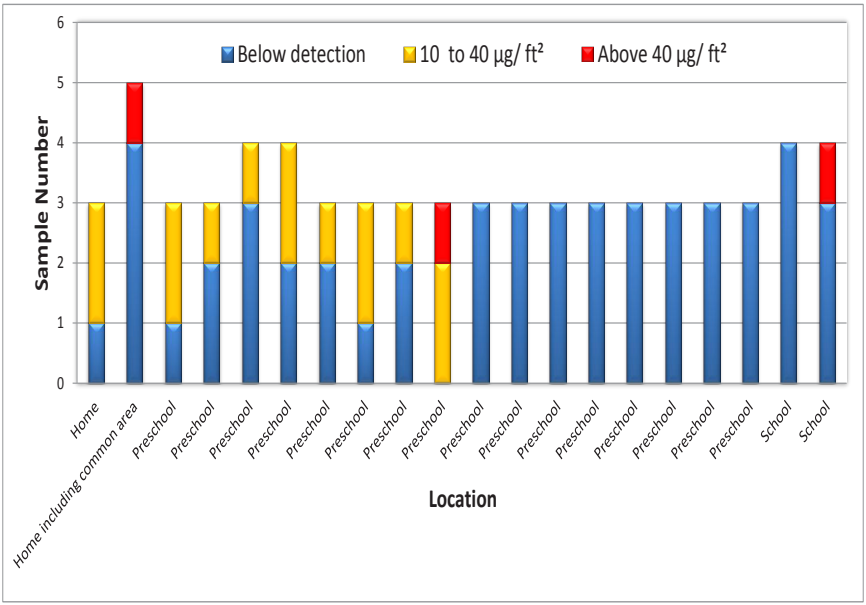


Figure 1: Lead content per sample at each location

The highest dust lead level recorded in this study, 600 µg/ft², was from a school where they had spilled paint on the floor. At another pre-school the dust lead level close to a chipping bookshelf with chipping paint was 31 µg/ft². This shows the importance of keeping children´s environment free of damaged paint or paint spills.

The second highest lead level was recorded in a sample from a hallway stair case of a housing scheme, which was 174 µg/ft². However, the samples from the adjacent house were not contaminated with lead. This shows that care also needs to be taken to control dust in common areas of buildings.

The third location where three samples contained high levels of lead, 110 µg/ft², 47 µg/ft², and 39 µg/ft², was at a newly established pre-school. The start-up of the preschool was preceded by a renovation, which is a probable cause of the high levels of lead in the dust. This shows the need for proper procedures to be used when renovating painted areas not to create hazardous dust.

Samples from one location where there was a baby in the house had a dust lead level of 31 and 33 µg/ft². These levels were recorded at the living room near the wall and the baby's

room near where they had a baby table and chair, and could be cause for special concern. The level recorded at the entrance of this location was below detection (<8 µg/ft^2).

Table 1 Results of the dust sample analyses

Location	Type	Total no. of samples	Below detection (8 µg/ft2)	10 - 40 µg/ft^2	Above 40 µg/ft^2
1	Home	3	33% (1 of 3)	67% (2 of 3)	0% (0 of 3)
2	Preschool	3	33% (1 of 3)	50% (2 of 3)	0% (0 of 3)
3	Preschool	3	67% (2 of 3)	33% (1 of 3)	0% (0 of 3)
4	Home including common area	5	80% (4 of 5)	0% (0 of 5)	20% (1 of 5)
5	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
6	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
7	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
8	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
9	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
10	Preschool	4	75% (3 of 4)	25% (1 of 4)	0% (0 of 4)
11	Preschool	4	50% (2 of 4)	50% (2 of 4)	0% (0 of 4)
12	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
13	School	4	100% (4 of 4)	0% (0 of 4)	0% (0 of 4)
14	Preschool	3	67% (2 of 3)	33% (1 of 3)	0% (0 of 3)
15	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
16	Preschool	3	100% (3 of 3)	0% (0 of 3)	0% (0 of 3)
17	School	4	75% (3 of 4)	0% (0 of 4)	25% (1 of 4)
18	Preschool	3	33% (1 of 3)	67% (2 of 3)	0% (0 of 3)
19	Preschool	3	67% (2 of 3)	33% (1 of 3)	0% (0 of 3)
20	Preschool	3	0% (0 of 3)	33% (1 of 3)	67% (2 of 3)

CASE STUDY

THE FUTURE AT RISK

CEJ's lead dust sampling team visited 20 schools and pre-schools this year during a period when children and teachers were preparing for their school sports meet events. For the kindergarten students drill display, teachers were painting sticks, coconut shells and various other items in very bright colors.

At one location, the CEJ team immediately spotted a paint spill in children's hall area, an area used both as a main hall and as a classroom for kindergarten students (Grade 1-2). Dust samples taken in this area had lead levels almost sixty times greater than (the 10 µg/ft2) referred to earlier in this report (see page 10). This occurred despite the fact that other areas of the school where we collected samples contained lead levels below the detection limit in this study. We were all quite shocked at the results.

Studies have shown that an area of one square centimeter painted with lead paint can contaminate up to a square meter area once the paint degrades to dust, which inevitably occurs in areas of high traffic or use like classrooms and hallways. In this case, we measured a contamination level equal to 600 micrograms per square foot (i.e. almost 6,500 micrograms per square meter).

We also recorded high lead levels in dust at a newly established pre-school where a recent renovation had taken place and where we saw chipping paint. The children's chairs and tables were brightly coloured in red, yellow and green paints, which, as we demonstrated in an earlier lead paint study, are likely to contain high levels of lead (CEJ, 2009). This lead contamination, we suspected, resulted from sanding the paint surface prior to the new paint's application without applying proper safety measures and then insufficient cleaning afterwards.

On the other hand, some of areas that we sampled at this school did not contain lead above the detection limit, possibly because lead free paint had been used during the recent renovation. During an initial survey conducted prior to the sampling, the CEJ team had explained the problem of lead contamination to the teachers. They showed us the paint cans they had used, and sought more information about how to purchase lead safe paints because they paint their premises annually.

It is also important to note, that we frequently found lead-contaminated dust in the corners of rooms. Dust from loosening paint tends to accumulate in this area, and a too

hasty sweeping job will miss it. Similarly, corridor areas in common housing schemes can contain loads of dust with lead.

At some schools, we also saw mothers applying paint on toys without a face mask or other personal protection. None of them were aware of the problem of lead contamination and its impact on children's health and development.

One good example we saw was at a religious institution that takes every recommended measure for lead safety. Tiled floors extend up the wall two to three feet from the ground, which prevents young children from coming in contact with peeling paint on the wall. However, because they are aware of the issue, they also use a lead safe paint on the wall areas. They mop the school every evening when all children leave the premises. They wash all the toys that little children use (chew or play with); they do not let children play with unsuitable items such as broken electronic devices; they also use plastic chairs and tables. Finally caretakers make sure the children wash their hands properly before meals or when any food is taken.

As a final point, we just want everyone to know: "Household Lead poisoning is a risk that completely preventable, once we learn the issues, stop producing and buying lead paints, and take preventive mechanisms".

RECOMMENDATIONS

GOVERNMENT AND GOVERNMENT AGENCIES

Strengthen the existing legislation for household paint products by revising the allowed concentration of lead in enamel paints to be the same as for emulsion paints, 90 ppm.

Establish strong enforcement measures including periodic monitoring to ensure paint companies are in compliance with the legal limit for lead content in household paint products

Provide incentives to paint companies to swiftly transition from lead to non-lead paint production.

Require paint container labels to indicate the lead content and provide a warning of possible lead dust hazards when disturbing painted surfaces

Source only unleaded paints for interiors of public buildings, government-sponsored housing, schools, day care centres, medical facilities etc.

PAINT INDUSTRY

Discontinue the use of lead as driers or pigments and other purposes in paint formulations and shift to non-lead substitutes

Commit to an expedited switch to producing all paint products with lead content below 90 ppm, and provide lead-dust hazard warnings on paint can labels.

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

Provide information to paint vendors on lead hazards that can be distributed to customers.

CONSUMERS

Ask for unleaded paints for safer homes and patronize businesses that sell unleaded paints

If you are concerned about lead paint in your home, please see recommendations in Appendix 3 of this report

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.

Promote efforts to make blood lead testing available.

Encourage specification of "non-leaded paints" on purchase orders of larger paint consumers such as schools, day-care centers, large housing property owners/managers.

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

REFERENCES

Attina, T. M. and Trasande, L. (2013) Economic Costs of Childhood Lead Exposure in Low- and Middle-Income Countries, Environmental Health Perspectives. 121, 1097-1102.

Bellinger, D. C. (2008) Very low lead exposures and children's neurodevelopment, Current Opinion in Pediatrics. 20, 172-177.

Cecil, K. M., Brubaker, C. J., Adler, C. M., Dietrich, K. N., Altaye, M., Egelhoff, J. C., Wessel, S., Elangovan, I., Hornung, R., Jarvis, K. and Lanphear, B. P. (2008) Decreased brain volume in adults with childhood lead exposure, Plos Medicine. 5, 741-750.

Centers for Disease Control and Prevention (CDC) (2013) Blood Levels in Children Aged 1-5 Years – United States, 1999-2010, Morbidity and Mortality Weekly Report. 62, 245-248.

Centers for Disease Control and Prevention (CDC) (2013) Guidelines for Measuring Lead in Blood Using Point of Care Instruments. Available at http://www.cdc.gov/nceh/lead/ACCLPP/20131024_POCguidelines_final.pdf

Centre for Environmental Justice (CEJ) (2013) Lead in Sri Lanka's New Enamel Household Paints. Available at http://www.ejustice.lk/PDF/Lead%20paint%20study%202013%20Final.pdf

Clark, C. S., Bornschein, R. L., Succop, P., Hee, S. S. Q., Hammond, P. B. and Peace, B. (1985) Condition and type of housing as an indicator of potential environmental lead-exposure and pediatric blood lead levels, Environmental Research. 38, 46-53.

Dixon, S., Wilson, J. and Galke, W. (2007) Friction and impact surfaces: are they lead-based paint hazards?, Journal of Occupational and Environmental Hygiene. 4, 855-863.

Dixon, S.L., Gaitens, J.M., Jacobs, D.E., Strauss, W., Nagaraja, J., Pivetz, T., et al. (2009) Exposure of U.S. children to residential dust lead, 1999–2004: II. The contribution of lead-contaminated dust to children's blood lead levels. Environmental Health Perspectives 117, 468–474

Gaitens, J. M., Dixon, S. L., Jacobs, D. E., Nagaraja, J., Strauss, W., Wilson, J. W. and Ashley, P. J. (2009) Exposure of US Children to Residential Dust Lead, 1999-2004: I. Housing and Demographic Factors, Environmental Health Perspectives. 117, 461-467.

Gulson, B., Anderson, P. and Taylor, A. (2013) Surface dust wipes are the best predictors of blood leads in young children with elevated blood lead levels, Environmental Research. 126, 171-178.

Jacobs, D. E., Clickner, R. P., Zhou, J. Y., Viet, S. M., Marker, D. A., Rogers, J. W., Zeldin, D. C., Broene, P. and Friedman, W. (2002) The prevalence of lead-based paint hazards in US housing, Environmental Health Perspectives. 110, A599-A606.

Lanphear, B. P., Hornung, R., Ho, M., Howard, C. R., Eberly, S. and Knauf, K. (2002) Environmental lead exposure during early childhood, Journal of Pediatrics. 140, 40-47.

Lanphear, B. P., Matte, T. D., Rogers, J., Clickner, R. P., Dietz, B., Bornschein, R. L., Succop, P., Mahaffey, K. R., Dixon, S., Galke, W., Rabinowitz, M., Farfel, M., Rohde, C., Schwartz, J., Ashley, P. and Jacobs, D. E. (1998) The contribution of lead-contaminated house dust and residential soil to children's blood lead levels, Environmental Research. 79, 51-68.

Mazumdar, M., Xia, W. M., Hofmann, O., Gregas, M., Sui, S. H., Hide, W., Yang, T., Needleman, H. L. and Bellinger, D. C. (2012) Prenatal Lead Levels, Plasma Amyloid beta Levels, and Gene Expression in Young Adulthood, Environmental Health Perspectives. 120, 702-707.

Mielke, H. W. and Zahran, S. (2012) The urban rise and fall of air lead (Pb) and the latent surge and retreat of societal violence, Environment International. 43, 48-55.

Miranda, M. L., Kim, D., Galeano, M. A. O., Paul, C. J., Hull, A. P. and Morgan, S. P. (2007) The relationship between early childhood blood lead levels and performance on end-of-grade tests, Environmental Health Perspectives. 115, 1242-1247.

Prüss-Üstün, A. and Corvalán, C. (2006) Preventing disease through healthy environments: Towards an estimate of the environmental burden of disease.

U.S. Department of Housing and Urban Development (HUD) (2012) Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing.

U.S. Environmental Protection Agency (US EPA) (2008) Child-Specific Exposure Factors Handbook (Final Report).

World Health Organization (WHO) (2010) Childhood lead poisoning.

APPENDIX 1

DUST SAMPLING METHODOLOGY

SELECTION OF SAMPLING LOCATIONS

Dust samples were taken indoors in 2 houses, 16 pre-schools and 2 primary/ secondary schools. The following criteria were used in selecting sample locations:

- Housing in areas with no visible other potential sources of lead contamination (such as industrial or recycling areas)
- Houses with damaged paint on the interior surfaces
- Houses whose interiors are painted in bright colors
- Houses with painted surfaces that are subjected to a lot of wear and tear, such as wooden windows and wooden door/ doorframes
- Houses that have undergone repainting, general renovations, or significant maintenance projects

Figure 2 : Three major towns where samples were collected:. 4 samples from Borella, 3 samples from Kottawa and 13 samples from Dehiattakandiya.

Two months prior to sampling, representatives of Centre for Environmental Justice contacted adult residents living in houses in Colombo 08, Dehiattakandiya and Kottawa identified as potential lead dust sources. Permission to sample a total of 20 homes/ schools was given. In all cases residents were provided with information about the hazards of lead exposure, the reasons why lead dusting at their house/school might be appropriate; and the lead dust sample collection and analysis process. The results from the individual locations were shared with each participant prior to release (Appendix 2). Residents were also given information about proper procedures for cleaning lead dust (Appendix 3). The sampling was conducted by representatives of Centre for Environmental Justice.

MATERIALS

The following materials were used for dust wipe sampling:

- Disposable Wipes, ASTM standard for lead in surface dust
- Gloves, Non-sterilized and non-powdered
- Zip Lock bags
- Tape
- Square plastic template (1 X 1 ft.)
- Wet wipes for cleanup
- Centrifuge Tubes (50 ml size), certified lead free

SAMPLE COLLECTION.

The dust samples were collected according to the dust wipe method described by the U.S. Department of Housing and Urban Development (HUD, 2012):

1. The surface to be sampled was determined
2. The template (a rectangle the size of 1 ft2) was carefully placed on the sample area and the outside edges were taped to the floor to keep it from moving while wiping
3. The wipes were inspected in order to make sure they were moist, and the plastic containers to make sure they were unopened and still uncontaminated.
4. The caps of the plastic containers were party unscrewed, and a clean pair of disposable gloves was donned.
5. A first pass with the wipe was made side-to-side with as many "S"-like motions as were necessary to completely cover the entire sample area.
6. The wipe was folded with the contaminated side facing inward, and a second pass was made top-to-bottom in the same "S"-like motions as previous pass.
7. The wipe was again folded with the contaminated side facing inward, and a third wipe pass was made around the perimeter of the sampled area.

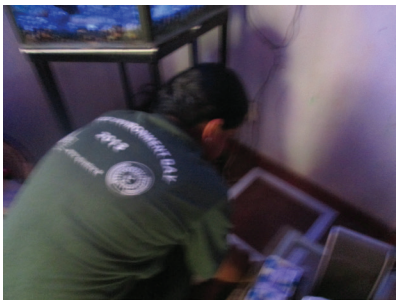
8. The wipe was again folded with the contaminated side facing inward again, and inserted without touching anything else into the centrifuge tube. The lid was securely fastened, and the tube labeled.

Field blanks were prepared after every 20 samples, by removing a wipe from the package with a new glove, shaking the wipe open and refolding it in a manner similar to that used during the actual wipe sampling procedure. The blank was inserted in the same way it into a centrifuge tube without touching any other surface or object, and the tube labeled with a sample number. All blanks were labeled in a similar way as the dust samples to keep them undisclosed to the lab. Field sampling forms were filled-in and kept throughout the sampling to keep track of each sample identity and details.

The samples were analyzed using method NIOSH 7082 (LEAD by Flame AAS).

APPENDIX 2

DUST STUDY RESULTS



Location: A private home at Colombo District

Paint Characteristics: Chipping wall painted in purple near a window at the living room

Floor dust lead level: 33 µg/ft^2

Location: A private home at Colombo District

Paint Characteristics: Yellow painted wall, brightly colored baby's table in the baby's room

Floor dust lead level: 31 µg/ft^2

Location: A pre- school at Colombo District

Paint Characteristics: Floor painted in red

Floor dust lead level: 28 µg/ft^2

Location: A pre-school at Colombo District

Paint Characteristics: Rack with chipping red paint

Floor dust lead level: 31 µg/ft^2

Location: A pre- school at Colombo District

Paint Characteristics: Bright green, red and blue paint on desks and chairs, red paint on floor

Floor dust lead level: 10 µg/ft^2

Location: Common area of a housing scheme at Colombo District

Paint Characteristics: Chipping red paint of the staircase paling

Floor dust lead level: 174µg/ft^2

Location : A pre-school at Ampara District

Paint Characteristics: Red polish and chipping paint on an old wall painting

Floor dust Lead level: 15 µg/ft^2

Location: A pre-school at Ampara District

Paint Characteristics: Chipping green colour paint on wall

Floor dust lead level: 11µg/ft^2

Location: A pre-school at Ampara District

Paint Characteristics: Chipping paint on wall and brightly colored tables and chairs

Floor dust lead level: 21 µg/ft^2

Location: A pre-school at Ampara District

Paint Characteristics: Brightly colored door, tables and chairs

Floor dust lead level: 26 µg/ft^2

Location: A pre-school at Ampara District

Paint Characteristics: A spill of red enamel paint on the floor, brightly colored wall in yellow

Floor dust lead level: 600 µg/ft^2

Location: A pre-school at Colombo District

Paint Characteristics:
a window with chipping paint, brightly colored tables and chairs, floor with fading red paint

Floor dust lead level: 12 µg/ft^2

Location: A pre-school at Colombo District

Paint Characteristics: Brightly colored tables and chairs, chipping paint on wall, floor with fading red paint

Floor dust lead level: 11 µg/ft^2

Location: A pre-school at Colombo district. A newly established place facing the main road.

Paint Characteristics: brightly colored tables and chairs, floor with fading red polish.

Floor dust lead level: 110 µg/ft^2

Location: A pre-school at Colombo district. A newly established place facing the main road.

Paint Characteristics: Brightly colored tables and chairs, chipping paint on wall, floor with fading red paint

Floor dust lead level: 47 µg/ft^2

Location: A pre-school at Colombo district. A newly established place facing the main road.

Paint Characteristics: Brightly colored tables and chairs, chipping paint on wall, floor with fading red paint

Floor dust lead level: 39 µg/ft^2

APPENDIX 3

KEEPING YOUR HOME LEAD DUST FREE

KEEP YOUR HOME CLEAN THROUGH WET WIPING.

Ordinary household dust and dirt may contain lead. Children can swallow lead or breathe lead contaminated dust if they play in dust or dirt and then put their fingers or toys in their mouths, or if they eat without washing their hands first.

- Keep the areas where your children play as dust-free and clean as possible.
- Wash pacifiers and bottles after they fall on the floor. Keep extras handy.
- Clean floors, window frames, window sills, and other surfaces weekly. Use a mop, sponge, or paper towel with warm water and a general all-purpose cleaner.
- Thoroughly rinse sponges and mop heads after cleaning dirty and dusty areas.
- Wash toys and stuffed animals regularly.
- Make sure your child does not chew on anything covered with paint, such as painted window-sills, cribs, or playpens.

HANDLE PAINTED SURFACES CAREFULLY AND ASSUME THEY CONTAIN LEAD UNLESS IT HAS BEEN MEASURED AND FOUND NOT TO CONTAIN LEAD.

Families have been poisoned by scraping or sanding lead paint because these activities generate large amounts of lead dust. Lead dust from repairs or renovations of older buildings can remain in the building long after the work is completed. Heating paint may release lead into the air.

- Don't burn, dry scrape or dry sand painted surfaces as they may contain lead. Wet scrape or wet sand surfaces so that the dust does not spread and can be readily collected and removed.
- Children and pregnant women should not be present in housing undergoing substantial renovation, participate in activities that disturb old paint, or clean up paint debris after work is completed.
- Isolate areas when wet scraping or wet sanding or other actives disturbing painted surfaces from living and play areas. Close and lock doors to keep children away from dusty areas or where paint is chipping or peeling. As temporary measures until full repairs can be made cover holes in walls or seal off openings, so children aren't exposed to paint dust.

TRY TO AVOID BRINGING LEAD DUST INTO THE HOME.

People may unknowingly bring lead into the home on their hands or clothes.

- If possible, people working in construction, demolition or painting or who work with batteries, or in a radiator repair shop or lead factory should change their clothes and shower before going home. If that's not possible, keep work clothes separate from other household items and away from children.
- Try to keep children from eating dirt, and make sure they wash their hands when they come inside.

EAT RIGHT

Feed children healthy, low-fat foods high in calcium, iron, and vitamin C. Lead in the body stops good vitamins, such as iron and calcium, from working right.

Centre for Environmental Justice
is a public interest environmental organization based in Sri Lanka working towards environmental justice and good governance.

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.