National Report

Lead in New Enamel Household Paints in Thailand

June 2015

Acknowledgements

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This report was produced as part of the Asian Lead Paint Elimination Project. The Asian Lead Paint Elimination Project was established to eliminate lead in paint and raise widespread awareness among business entrepreneurs and consumers about the adverse human health impacts of lead-based household enamel paints, particularly on the health of children under six years old.

The 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 Euros. While this report has been produced with the assistance of the European Union, its contents are the sole responsibility of EARTH together with IPEN, and can in no way be taken to reflect the views of the European Union. In addition, this report was produced with financial contributions from the Swedish Environment Protection Agency and 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.

Ecological Alert and Recovery - Thailand (EARTH) is an independent non-profit organization striving for social and environmental sustainability and justice in Thai society. EARTH serves as a watchdog monitoring the Thai government's industrialization policy, industrial pollution and unsustainable consumption patterns. EARTH promotes climate justice, good governance and accountability of governmental and international agencies. EARTH focuses on the impacts of hazardous substances on ecosystems, local communities and workers' health.

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Photo by Nicha Rakpanichmanee

Preface

Leaded paints for home use continue to be widely produced, sold and used in developing countries despite the fact that most highly industrial countries banned leaded house paints more than 40 years ago.

In 2007 and 2008, NGOs in the IPEN network collected and analyzed decorative (home use) paints on the market in 11 developing countries, and in countries with economies in transition. The results were startling. In every one of these countries, many of the paints had dangerously high lead content. In response, IPEN launched a worldwide lead paint elimination campaign. Since then, IPEN-affiliated NGOs and others have sampled and analyzed paints on the market in approximately 40 low- and middle-income countries. In every country where there was no law or regulation prohibiting, the paints had high, and often dangerously high, lead contents.

This 2015 National Report on Lead Paint presents new data on the lead content of decorative enamel paints that are offered for sale in the Thai market. This is the third time that Ecological Alert and Recovery - Thailand (EARTH) has analyzed paints sold in Thailand for their lead content. Previous studies were conducted in 2010 (31 enamel paints from 29 brands) and 2013 (120 enamel paints from 68 brands). These studies found that Thai children and consumers continue to be exposed to dangerously high levels of lead content in enamel paints. In the 2010 study, 81 percent of paints sampled contained lead above the Thai voluntary standard of 100 parts per million (ppm, dry weight of the paint), and more than half or 55 percent of paints sampled contained lead above 10,000 ppm. In 2013, a more extensive sampling study was conducted, following a national paint market survey with the purpose of including as many paint brands and paint manufacturers as possible. The 2013 study found similar results: 79 percent of samples contained lead above the voluntary standard of 100 ppm, and almost half or 40 percent of samples contained lead above 10,000 ppm.

In addition to new data on lead in paint, this report also present background information on why the present and former use of decorative enamel paint with high lead content is a source of serious concern, especially to children's health. It also proposes action steps by different stakeholders to protect children and others from lead paint and lead dust.

Photo by Nicha Rakpanichmanee

Executive Summary

While lead exposure is also harmful to adults, lead exposure harms children at much lower levels, and the health effects are generally irreversible and can have a lifelong impact. The younger the child, the more harmful lead can be, and children with nutritional deficiencies absorb ingested lead at an increased rate. The human fetus is the most vulnerable, and a pregnant woman can transfer lead that has accumulated in her body to her developing child. Lead is also transferred through breast milk when lead is present in a nursing mother.

Evidence of reduced intelligence caused by childhood exposure to lead has led the World Health Organization (WHO) to list "lead-caused mental retardation" as a recognized disease. WHO also lists it as one of the top ten diseases whose health burden among children is due to modifiable environmental factors.

Most highly industrialized countries adopted laws or regulations to control the lead content of decorative paints - the paints used on the interiors and exteriors of homes, schools, and other child-occupied facilities - beginning in the 1970s and 1980s. No similar regulation is yet in place in Thailand, although in early 2015 the Thai Industrial Standards Institute completed draft legislation requiring mandatory standards on lead content in enamel paints of no more than 100 ppm.

In 2014-2015, Ecological Alert and Recovery - Thailand (EARTH) purchased a total of 100 cans of solvent-based enamel decorative paints for lead content analysis, in order to compare with previous studies and identify trends in the removal or reduction of leaded ingredients among paints sold in the Thai market. This 2015 study focuses only on paints which were previously found to contain lead content above the Thai voluntary standard of 100 ppm. In addition, manufacturing dates were examined to ensure that the 2015 study reflects paints manufactured more recently than previous samples in 2013 and 2010. The 100 paint samples in this study represent 56 brands produced by 35 paint manufacturers. All paints were analyzed by an accredited laboratory in Europe for their total lead content, based on dry weight of the paint. This is the third study EARTH has released about the lead content of new decorative enamel paints in Thailand.

The paint study was undertaken as part of the Asian Lead Paint Elimination Project. The Asian Lead Paint Elimination Project carries out focused activities to eliminate lead paint from the market in seven project countries - Bangladesh, India, Indonesia, Nepal, Philippines, Sri Lanka, and Thailand.

Findings

Analysis of lead content in samples from 100 enamel paints representing 56 brands and 35 manufacturers showed:

- Approximately one third of paint manufacturers (11 of 35 manufacturers) have either reduced or eliminated the use of leaded ingredients in paint production, compared with the same brands sampled in previous studies.
- The average lead concentration for white paints was 991 ppm, lower than the average lead concentration of 31,341 ppm for bright color paints, and 35,000 ppm for yellow paints.
- No correlation was found between retail price and lead content, similar to findings from the previous study in 2013, suggesting that the use of leaded ingredients may not be the main factor in determining retail price by paint manufacturers.
- Of the paint samples with lead-free labeling in 2013 and 2015, it was found that fewer paints in 2015 contain lead levels above 100 ppm, suggesting that manufacturers are more attentive to accurate advertising about lead-free paints.
- Among paints with lead-free labeling which were found to contain high content, most were first-party certification labels produced by manufacturers themselves. Only one paint sample contained lead content higher than the third-party certification standard issued by the Thai Industrial Standards Institute, suggesting that third-party certification has more enforcement authority.

Conclusions and Recommendations

This study found that one-third of Thai paint manufacturers have begun to reduce or eliminated the use of leaded ingredients in enamel paint production, including many small and medium enterprises (SMEs). The reduction of leaded ingredients has no correlation with retail price regardless of paint color, suggesting that lead content is not a major factor in determining retail price and that the elimination of leaded ingredients from paint production is feasible for paint manufacturers without causing economic hardship.

The results of this study are in line with results of the *Survey of Small and Medium Enterprises (SMEs) on the Development of Mandatory Standard of Lead Content in Household Paint Products* by EARTH and the National Institute of Development Administration (NIDA) in July 2014. Of the 129 SME paint manufacturers surveyed, 95 percent of paint manufacturers were "willing to comply with a mandatory standard" and 80 percent were "ready to take measures to comply with a mandatory standard." SME paint manufacturers called on the Thai government to "issue clearer measures" because the existing voluntary standard "lacked enforcement authority." In addition, paint manufacturers called on the government to enforce the mandatory standard with effective inspection and strict penalties to prevent non-compliance and illegal import of non-compliant products from neighboring countries. Furthermore, paint manufacturers requested that the government provide technical support for SMEs in transition and provide information to raise the awareness of consumers and the general public on the importance of unleaded paint.[1]

Results of this 2015 study compared with the 2013 study by EARTH further indicate a decline in the advertisement of false labels, claiming products with high lead content to be lead-free. The majority of false labels that do remain in the market are self-certified claims produced by individual paint manufacturers themselves. In contrast, the majority of products with government-certified labels are unleaded, true to their claims. These findings suggest that while increased public awareness about the danger of lead paint may have influenced paint manufacturers to be more cautious against false advertisement, self-certified lead-free labels still lack enforcement authority compared to government-certified labels.

In light of these findings, EARTH recommends that the Thai government recognizes lead paint elimination as a priority and expedites the review process for the mandatory standard on lead content in enamel paints (TIS 2625-2557) to ensure the safety of consumers and Thai children.

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1. Background

1.1 Health and Economic Impact of Lead Exposure

Children are exposed to lead from paint when deteriorating paint on walls, windows, doors, or other painted surfaces begins to chip or deteriorate and lead is released to dust and soil. When a surface previously painted with lead paint is sanded or scraped in preparation for repainting, very large amounts of lead-contaminated dusts also are produced and spread and can constitute a severe health hazard.[1]

Children playing indoors or outdoors get house dust or soil on their hands, and then ingest it through normal hand-to-mouth behavior. If the house dust or the soil is contaminated with lead, the children ingest lead. Hand-to-mouth behavior is especially prevalent in children aged six years and under, the age group most easily harmed by exposure to lead. A typical one- to six-year-old child ingests between 100 and 400 milligrams of house dust and soil each day.[2]

In some cases, children pick up paint chips and put them directly into their mouths. This can be especially harmful because the lead content of chips is typically much higher than what is found in dust and soils. When toys, household furniture, or other articles are painted with lead paint, children may chew on them and directly ingest the lead-contaminated, dried paint. Nonetheless, the most common way that children ingest lead is through lead-contaminated dust and soil that gets onto their hands.[3]

While lead exposure is also harmful to adults, lead exposure harms children at much lower levels, and the health effects are generally irreversible and can have a lifelong impact.[4] The younger the child, the more harmful lead can be, and children with nutritional deficiencies absorb ingested lead at an increased rate.[5] The human fetus is the most vulnerable, and a pregnant woman can transfer lead that has accumulated in her body to her developing child.[6] Lead is also transferred through breast milk when lead is present in a nursing mother.[7]

Once lead enters a child's body through ingestion, 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 lead can also affect the blood system, the kidneys, and the skeleton.[8]

It is generally agreed that one key element in lead toxicity is its capacity to replace calcium in neurotransmitter systems, proteins, and bone structure, altering function and structure and thereby leading to severe health impacts. Lead is also known to affect and damage cell structure.[9]

According to the World Health Organization (WHO): "Lead has no essential role in the human body, and lead poisoning accounts for about 0.6% of the global burden of disease."[10] Evidence of reduced intelligence caused by childhood exposure to lead has led WHO to list "lead-caused mental retardation" as a recognized disease. WHO also lists it as one of the top ten diseases whose health burden among children is due to modifiable environmental factors.[11]

In recent years, medical researchers have been documenting significant health impacts in children from lower and lower levels of lead exposure.[12,13] According to WHO: "There is no known safe level of exposure to lead."[14]

When a young child is exposed to lead, the harm to her or his nervous system makes it more likely that the child will have difficulties in school and engage in impulsive and violent behavior.[15] Lead exposure in young children is also

linked to increased rates of hyperactivity, inattentiveness, failure to graduate from high school, conduct disorder, juvenile delinquency, drug use, and incarceration.[16] Lead exposure impacts on children continue throughout life and have a long-term impact on a child's work performance, and-on average-are related to decreased economic success.

A recent study investigating the economic impact of childhood lead exposure on national economies in all low- and middle-income countries estimated a total cumulative cost burden of $977 billion international dollars[17] per year.[18] The study considered the neurodevelopmental effects on lead-exposed children, as measured by reduced IQ points, and it correlated lead exposure-related reductions in children's IQ scores to reductions in lifetime economic productivity, as expressed in lifelong earning power. The study identified many different sources of lead exposure in children, with lead paint as one major source. Broken down by region, the economic burden of childhood lead exposure as estimated by this study was:

- Africa: $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
- Thailand: $12.5 billion of economic loss, or 2.07% of national GDP

1.2 The Use of Lead in Paint

Lead is a toxic metal that is found in some paints.

Paints contain lead when the paint manufacturer intentionally adds one or more leaded compounds to the paint for some purpose. A paint product may also contain some amount of lead when paint ingredients contaminated with lead are used, or when there is cross-contamination from other product lines in the same factory. Water-based paints are rarely contaminated with lead, but solvent-based enamel paints have been found to have high lead content in many countries.[19]

The leaded compounds most commonly added to paints are pigments. Pigments are used to give the paint its color, make the paint opaque (so it covers well), and protect the paint and the underlying surface from degradation caused by exposure to sunlight. Lead-based pigments are sometimes used alone, and sometimes used in combination with other pigments.

Leaded compounds also may be added to enamel paints for use as driers (sometimes called drying agents or catalysts). Leaded compounds are also sometimes added to paints used on metal surfaces to inhibit rust or corrosion. The most common of these is lead tetroxide, sometimes called red lead or minium.

Non-leaded pigments, driers, and anti-corrosive agents have been widely available for decades, and are used by manufacturers producing the highest quality paints. When a paint manufacturer does not intentionally add lead compounds in the formulation of its paints, and takes care to avoid the use of paint ingredients that are contaminated with lead, the lead content of the paint will be very low -less than 90 parts per million (ppm) total lead by dry weight and frequently down to 10 ppm or less. In contrast, when a manufacturer uses leaded pigments, lead content of the paint will usually be above 10,000 ppm. When a manufacturer does not use any leaded pigments but uses leaded drying agents, lead content of the paint will usually fall between 2,000 to 10,000 ppm. Lead levels below 2,000 ppm indicate the contamination of other leaded ingredients and/or contamination in the production process.[20]

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

The use of lead in production of decorative paint is prohibited in the European Union through regulations related to safety of consumer products and specific prohibitions for most leaded raw materials. In the U.S., Canada, Australia and other countries with regulations restricting the use of leaded ingredients in decorative paint, standards specifying a maximum lead limit are in place. The current standard for household paints in the U.S. and Canada is 90 ppm, and adherence to this ensures that a manufacturer can sell its paint anywhere in the world. Some other countries have established standards of 600 ppm.

1.3 Paint Market and Regulatory Framework in Thailand

Paint Market in Thailand

According to Thai Paint Manufacturers Association (TPMA) estimates in January 2013, there are approximately 200 paint manufacturers nationwide. Only 63 percent of all paint manufacturers (126 companies) are legally registered, and only 18 percent (36 companies) are members of the association.[21] Nonetheless, the TPMA has expressed support for a future ban of leaded paint. TPMA conducted an industry-wide survey in May 2012 and presented its findings at the Second Meeting of the Global Alliance to Eliminate Lead Paint in July 2012, indicating that Thai paint companies are willing to transition away from the use of lead compounds.[22] TPMA is supportive of either mandatory standards or a future ban on leaded paint, but requested that the government provide sufficient time and support measures for implementation.[23]

There is a lack of financial disclosure in the Thai paint market due to the fact that 99 percent of paint manufacturers are not public companies. Factory registration data at the Thai Department of Industrial Works (DIW) as of October 11, 2013 indicates that there are 307 facilities employing a total of 10,168 employees producing products for painting, spraying or coating surfaces - categorized as DIW factory class 45(1). Only 2 factories (1 percent) are registered as public companies. Thirty-eight factories (12 percent) are family businesses registered to individuals or as limited partnerships. Two hundred and sixty-seven factories (87 percent) are registered as limited companies, which are not required to disclose financial information to the public.[24]

As a result, estimates on the value of Thailand's paint industry vary widely, and are mostly based on speculations by paint manufacturers themselves. The total value of Thailand's domestic paint market in 2014 is approximately 22 billion baht (579 million EUR)[25] with estimated annual growth of 5 percent (Kasikorn Bank Research Center 2010).[26]

The share of the decorative paint market ranges from 49 percent[27] to 65 percent[28] of the entire paint market in Thailand. Market share estimates are projected by paint manufacturers themselves for decorative and industrial paint markets combined, and do not add up to one hundred percent. It is widely accepted that TOA Group - which includes TOA Paint (Thailand) and Captain Coating - holds the largest market share in Thailand's paint market, ranging from 40 percent[29] to 54 percent.[30] Other dominant paint manufacturers include Akzo-Nobel Paint (Thailand) with 15 percent

market share,[31] Nippon Paint (Thailand) with 10-14 percent market share,[32] Thai Kansai Paint with 13 percent market share,[33] Jotun Thailand with 9-12 percent market share,[34] and Beger (paint factory registered under the company name B.N. Brother) with 10 percent market share.[35] Of these six dominant paint manufacturers, three are subsidiaries of foreign companies (Akzo-Nobel, Nippon and Jotun based in the Netherlands, Japan and Norway, respectively), two are Thai companies (TOA and Beger) and one is a joint venture between Japanese and Thai businesses (Thai Kansai Paint).

Virtually all paints sold in Thailand are produced domestically. Thai manufacturers, including foreign companies with production bases in Thailand, export mostly to ASEAN countries (63% of worldwide export value), followed by India (9%), Australia (4.5%) and China (4%). The largest export market for Thai paints is the Philippines, which purchased 14% of worldwide export value in 2014, or over 5,300 tons of paint products each year.[36]

Lead Paint Regulatory Framework

In the past, the Thai paint industry had largely been self-regulated. Thailand issued voluntary standards for lead in household paint as early as 1978, beginning with water-based (emulsion) paints, issued one year after a market leader in the paint industry began advertising lead-free paint products.[37,38] Today, the voluntary standard for lead in emulsion paints is 100 ppm for many different types of paints: general use, weather-resistant, fire-resistant, solar heat reducing, and glossy emulsion paints.[39] In 2010, the voluntary standard for lead in enamel paints was reduced from 600 ppm to 100 ppm for glossy and matte enamel paints.[40] Today, a number of Thai companies are beginning to advertise "lead-free" paint products, but rely mostly on a self-certification system.

In 2014, the Thai government completed a draft mandatory standard on heavy metal content in household paint. The Safety Standard for Alkyd Enamel Paints, or Thai Industrial Standard (TIS) 2625-2557, restricts the content of four heavy metals: no more than 0.01 percent (or 100 ppm) for lead, mercury, cadmium and 0.10 percent (or 1,000 ppm) for hexavalent chromium in ll enamel paints. [41]

Image 1: Beginning of public awareness campaign on lead paint elimination in Thailand: joint press conference by Ecological Alert and Recovery - Thailand (EARTH) and the Foundation for Consumers, as appeared in Smart Buyer Magazine, August 2009.

Image 2: *A seminar in Khon Kaen, northeastern Thailand, as part of a series of events in January-March 2014 organized by the Thai Industrial Standards Institute to promote awareness among business entrepreneurs and local governments about the danger of leaded paint and compliance with mandatory product standards.*

Photos by Thai Industrial Standards Institute

Thailand's policy commitment toward lead paint elimination follows several years of civil society campaign and collaboration with academic institutions, government agencies and public interest organizations in consumer rights, environment and public health protection.

Beginning in 2009, the Thai NGO Ecological Alert and Recovery - Thailand (EARTH) began a public awareness campaign in collaboration with the Foundation for Consumers (FFC) on the danger of lead in Thai household paints.[42] (Image 1) In 2010, the Center for Child Safety Promotion and Injury Prevention (CSIP) at Ramathibodi Hospital studied sources of lead exposure in Thai childcare centers and found that lead paint was the main source of childhood exposure to lead. In October 2012, EARTH, FFC, CSIP and the Engineering Institute of Thailand conducted a joint press conference entitled "Lead in Household Paint: a Preventable Danger." In November 2012, the Thai National Assembly's Industry Committee, an advisory arm of Thailand's main legislative body, recommended the Prime Minister that existing standards for all types of paint products be converted to mandatory standards, and that the level of allowable lead be determined with human safety in mind.[43] The Industry Committee also recommended that public schools, childcare centers and government offices purchase only paint products that meet industrial product standards. The Office of Prime Minister heeded the recommendations and ordered the relevant ministries and agencies to follow the recommendations. In December 2012, the Ministry of Interior issued the same recommendations to all provincial governors and local government authorities.[44]

In January 2013, the Thai Industrial Standards Institute (TISI) invited all paint manufacturers in Thailand to a forum about producing paints in compliance with industrial product standards.[45] Beginning in February 2013, some local governments began to issue legally-binding municipal notices requiring that publicly-funded child-care centers purchase only paints that meet industrial standards for lead content.[46] In March 2013, the National Economic and Social Advisory Council submitted a set of recommendations to the Prime Minister entitled "Lead in Household Paints: a Preventable Danger."[47] In August 2013, the Thai Cabinet issued a cabinet resolution to implement the recommendations which include that voluntary industrial standards for lead content in enamel household paints become mandatory standards by the end of 2013. In addition, the Cabinet Resolution advised public schools to require the use of unleaded paints and advised the Office of Consumer Protection to require warning labels on the lead content in household paints by the end of 203.[48]

Widespread media coverage of the lead paint problem in Thailand followed the October 2013 release of Thailand's first comprehensive study on lead in paint, which found that as much as 79 percent of household enamel paints contained lead above the TISI voluntary standard of 100ppm.[49] (Image 3) TISI Director of Standards Management Bureau on Consumer and Chemical Products Benjamaporn Ekachart promised the Thai public that TISI would prepare a mandatory standard for lead in household paint within one year.[50] However, policy developments came to a temporary halt during widespread political protests in early 2014, including the blockade and forced shutdown of TISI, among many other national government offices throughout Bangkok. Nonetheless, from January to March 2014, TISI continued to organize seminars for local governments and business entrepreneurs in all regions of Thailand entitled "Danger of Paints, Toys and Playground Equipment." (Image 4) After the coup in May 2014, Thailand's government offices returned to normal operations. In June 2014, the Ministry of Industry issued the Safety Standard for Alkyd Enamel Paints (TIS 2625-2557) for voluntary enforcement in the Royal Gazette, as a temporary measure before enforcing it as a mandatory standard.[51] In August 2014, TISI released TIS 2625-2557 as a draft mandatory standard "in order to ensure safety and prevent damage to the public and national economy" and opened the draft regulation for one month of public comment.[52] In January 2015, TISI completed all internal academic and legal review processes and made no changes to TIS 2625-2557.

Image 3: *Example of nationwide media coverage about highly-leaded household paints and danger of lead-caused mental retardation: front page of Kom Chad Leuk newspaper on October 22, 2013.*

Image: Kom Chad Leuk

Image 4: *Opening ceremony of Lead Poisoning Prevention Day of Action on October 22, 2014 at the National Children's Hospital, jointly presided by WHO representative Dr. Liviu Vedrasco (left), Advisor to the Ministry of Public Health Siriwat Tiptaradol, MD (middle) and Vice Minister of Industry Pramote Wittayasuk (right).*

Photo by Karnt Thassanaphak

On March 25, 2015, Thailand's Vice Minister of Industry Atchaka Sribunruang announced the Ministry's commitment to issue the mandatory standard restricting the content of four toxic heavy metals - lead, mercury, cadmium and hexavalent chromium - in enamel paint products. This statement followed the former Vice Minister of Industry Pramote Wittayasuk's statement in support of lead paint elimination during his opening speech for Thailand's Lead Poisoning Prevention Day of Action in October 2014 at the National Children's Hospital, jointly organized by Thailand's Department of Disease Control, academic institutions and civil society organizations. (Image 4)

The Office of Consumer Protection Board also completed a draft regulation in January 2015 on labeling requirements for decorative paint products intended for both indoor and outdoor uses. The draft regulation requires paint products with higher than 100 ppm lead content to issue the warning: "Lead may be dangerous to the brain and red blood cells. Do not use to paint homes or buildings."[3]

In December 2014, the Philippines became the first country in the Association of Southeast Asian Nations (ASEAN) to issue lead paint elimination regulation. According to the Chemical Control Order for Lead and Lead Compounds, the Philippines would ban the production, distribution, import and recycling of leaded paint (containing more than 90 ppm lead content), effective in 2017 for decorative paints and 2019 for industrial paints.[54] In February 2015, Thailand's Department of Foreign Trade issued a statement alerting Thai manufacturers that "the Philippines values public health and safety" and that Thai paint manufacturers "should continuously improve the quality of their products" because Thailand exports as much as 616 million baht in paint products and varnishes to the Philippines each year.[55]

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2. Materials and Methods

Image 5: Paint samples prepared by applying paint to untreated wood before sending to the laboratory for analysis of total lead content of dry weight of the paint, using Inductively Coupled Plasma (ICP) spectroscopy

From November 2014 to January 2015, Ecological Alert and Recovery - Thailand (EARTH) purchased a total of 100 cans of solvent-based enamel decorative paints, in order to compare with the results of previous studies and identify trends in the removal or reduction of leaded ingredients among paints sold in the Thai market. For the purpose of comparison, this 2015 study focuses only on paint brands which were found in previous studies by EARTH to contain lead content above the Thai voluntary standard of 100 ppm. In addition, manufacturing dates were examined to ensure that the 2015 study reflects paints manufactured more recently than previous samples in 2013 and 2010.

The 100 paint samples in this study represent 56 brands produced by 35 paint manufacturers. Previous studies by EARTH identified 46 paint manufacturers producing paint for the Thai market, and found 2 manufacturers to produce unleaded paint in all brands sampled (no more than 100 ppm lead content consistently in all brands). These two paint manufacturers, Akzo Nobel Paint (Thailand) and Jotun Thailand, were excluded from this study on the assumption that they continue to produce unleaded paint in all brands. This study targeted the remaining 44 paint manufacturers which were found to produce paints with lead levels exceeding 100 ppm, either in some brands or all brands sampled. Of these 44 manufacturers, 11 manufacturers were not found at the time of this sampling in 2015. In addition, 2 additional paint manufacturers were discovered during paint purchasing and were included in this study due to the recent manufacturing dates of December 2013, September 2014 and October 2014 as indicated on the paint cans. For each brand sampled, EARTH purchased one white paint and one or more bright-colored paint (such

as red, orange or yellow), to the extent that they were available on the market at the time of sampling. Whenever available, EARTH purchased the same shade of bright paint as sampled from the same brand in previous studies. All paints were purchased from retail stores in Bangkok, Nakorn Pathom, Nonthaburi, Pathum Thani, Samut Prakarn and Samut Sakorn provinces. 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 for painting toys. A few samples of anti-corrosive paints were included, although they may be classified as industrial paints, because they are sold to consumers in retail stores for household decoration.

During the paint sample preparation, information such as color, brand, country where manufactured, purchase details, date manufactured as provided on the label of the paint can was recorded. The formats used for date of manufacturer varied with some companies providing day, month and year and others providing only month and year. In addition, some paint companies used only a single word to describe some colors, such as "red," while others used "bright red." Colors were recorded as provided on the can. For the red and yellow paints the protocol called for obtaining "bright" or "strong" red and yellow paints when available. Dates of purchase were recorded in the day/month/year format in most cases.

Paint sampling preparation kits containing individually numbered, untreated wood pieces, single-use paintbrushes and stirring utensils made from untreated wood sticks were assembled and shipped to EARTH by the staff of the IPEN partner NGO, Arnika, in the Czech Republic. Each can of paint was thoroughly stirred and was subsequently applied onto individually numbered triplicates of untreated wood pieces using different unused single-use paintbrushes by the staff of EARTH.

Each stirring utensil and paintbrush was used only once, and extra caution was taken to avoid cross contamination. All samples were then allowed to dry at room temperature for five to six days. (Image 5) After drying, the painted wood pieces were placed in individual resealable plastic bags and shipped to an ELPAT (Environmental Lead Proficiency Analytical Testing program) accredited lab in Europe for analysis of total lead content of dry weight of the paint. The paint samples were analyzed using Inductively Coupled Plasma (ICP) spectroscopy, as recognized by both the WHO and the United States Consumer Product Safety Commission as appropriate for the purpose.[1, 2]

References

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3. Results

A total of 100 cans of new enamel decorative paints were purchased in Bangkok, Nakorn Pathom, Nonthaburi, Pathum Thani, Samut Prakarn and Samut Sakorn provinces in Thailand and analyzed for total lead content. Results are given in parts per million (ppm) lead, based on dry weight of the paint. Please see Appendix A for detailed results.

Analysis of lead content in samples from 100 enamel paints representing 56 brands and 35 manufacturers showed:

- Approximately one third of paint manufacturers (11 of 35 manufacturers) have either reduced or eliminated the use of leaded ingredients in paint production, compared with the same brands sampled in previous studies.
- The average lead concentration for white paints was 991 ppm, lower than the average lead concentration of 31,341 ppm for bright color paints, and 35,000 ppm for yellow paints.
- No correlation was found between retail price and lead content, similar to findings from the previous study in 2013, suggesting that the use of leaded ingredients may not be the main factor in determining retail price by paint manufacturers.
- Of the paint samples with lead-free labeling in 2013 and 2015, it was found that fewer paints in 2015 contain lead levels above 100 ppm, suggesting that manufacturers are more attentive to accurate advertising about lead-free paints.
- Among paints with lead-free labeling which were found to contain high content, most were first-party certification labels produced by manufacturers themselves. Only one paint sample contained lead content higher than the third-party certification standard issued by the Thai Industrial Standards Institute, suggesting that third-party certification has more enforcement authority.

3.1 Reduction and removal of leaded ingredients

Of the 35 paint manufacturers sampled, approximately one third of paint manufacturers (11 of 35 manufacturers) have either reduced or eliminated the use of leaded ingredients in paint production, compared with the same brands sampled in previous studies. (Figure 1)

Among the 11 manufacturers showing reduction or removal of leaded ingredients, three are large companies, six are small and medium enterprises (SMEs) and two are not registered in the Thai government database.[1] Other paint manufacturers were found to have removed leaded ingredients from only white paints and still sell highly leaded paints either in some brands or some colors. (Table 1 and details in Appendix B)

Figure 1: Reduction and removal of leaded ingredients by paint manufacturer (2010-2015)

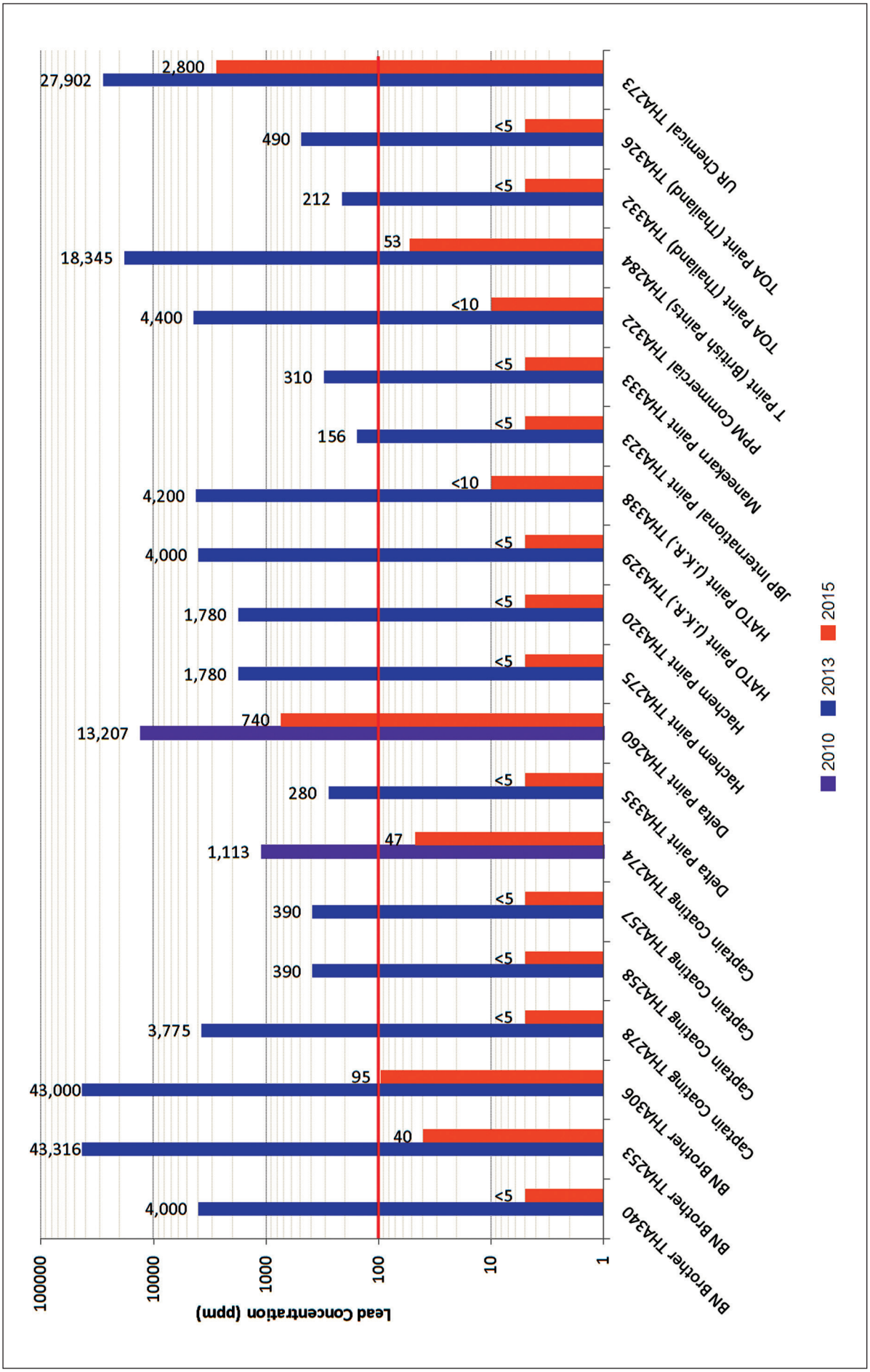


Table 1: Paint Manufacturers and Brands that have Reduced or Removed Leaded Ingredients

Paint Manufacturer*	Brands with Lead Reduction/Removal	Factory Size**	In all brands sampled?	Removal		Reduction		Range of Lead Levels Detected in 2010, 2013 (ppm)	Range of Lead Levels Detected in 2015 (ppm)
				B	W	B	W		
1. Captain Coating	Captain, Longlife, Mark	L	✓	✓	✓			390 - 3,775	<5 - 47
2. TOA Paint	Homecote, Kobe, Mandarin Duck, Supermatex, TOA Glipton	L	?	?	✓			<9 - 26,983	< 5 - 108
3. T. Paint	Rocket, Pammastic	n/a	?	?	✓			18,345	46 - 53
4. B.N. Brother	Beger Shield, Beger Delight Titanium, Ben-Tone	L	-	✓	✓			25 - 53,000	<5 - 35,000
5. PPM Commercial	Victor	S	✓[1]	-	✓	✓		4,400 - 63,000	< 10 - 52,000
6. Delta Paint	Delta, National	M	-	-	✓	✓		9 - 57,810	<5 - 41,000
7. Maneekarn Paint	DIY	n/a	✓[1]	-	✓			310 - 60,000	< 5 - 54,000
8. HATO Paint (J.K.R.)	HATO, N.O.C.	M	-	-	✓			4,000 - 56,339	<5 - 69,000
9. J.B.P. International	J.B.P.	M	-	-	✓			156 - 86,674	< 5 - 79,000
10. UR Chemical	Lobster	M	-	-	✓			61 - 27,902	< 5 - 2,800
11. Hachem Paint	Lotto	S	-	-	✓			1,780 - 39,447	< 5 - 46,000

* Excludes paint manufacturers found in 2013 study to already be producing unleaded paints consistently among all colors and all brands sampled, Akzo-Nobel Thailand and Jotun Thailand.[2]

** Department of Industrial Works (DIW) Registration Data for Paint Factories, Factory ID 45(1), last updated May 29, 2015.[3] Definition of factory sizes according to the Small and Medium Enterprise Development Bank of Thailand.[4] n/a = Paint manufacturer not registered in DIW database.

? Insufficient data, due to lead reduction in slightly different shades of bright color samples, 2013-2015.

✓[1] Only one brand found in current and previous sampling studies

3.2 Lead content analysis by color

Of the 100 paints tested for lead content, there were 41 paint samples in white shades (white and grey) and 59 paint samples in bright colors (yellow, orange and red). Analysis of lead content by color showed lower lead concentration in white shades (average lead level of 991 ppm) and higher lead concentration in bright color paints (average lead level of of 31,341 ppm). In addition, yellow paints were found most likely to contain extremely high lead content, exceeding 10,000 ppm (average lead level of of 35,000 ppm). (Table 2)

Table 2: Lead content analysis by color, 2015

Paint Color	Number of Samples	Paints with lead level ≤ 100 ppm	Paints with lead level > 100 ppm	Paints with lead level > 10,000 ppm	Average Lead Level Detected
White Shades	**41**	**59% (24 samples)**	**41% (17 samples)**	**0**	**991 ppm**
- White	38	58% (22 samples)	42% (16 samples)	0	1,060 ppm
- Grey	3	67% (2 samples)	33% (1 samples)	0	115 ppm
Bright Colors	**59**	**24% (14 samples)**	**76% (45 samples)**	**68% (40 samples)**	**31,341 ppm**
- Yellow	47	23% (11 samples)	77% (36 samples)	72% (34 samples)	35,000 ppm
- Red	7	29% (2 samples)	71% (5 samples)	43% (3 samples)	19,300 ppm
- Orange	5	20% (1 sample)	80% (4 samples)	60% (3 samples)	13,800 ppm
Total Samples	**100**	**38**	**62**	**40**	

3.3 Retail price and lead content

No correlation was found between retail price and lead content, similar to findings from the previous study in 2013.[5]

To exclude variables in price setting for different retail volumes, analysis on paint prices was based only on samples of the same retail volume, namely the ¼ gallon can (0.75-0.946 liters). Of the 100 samples, 83 samples representing 48 brands and 32 paint manufacturers were of the same retail volume of ¼ gallon cans. (Details in Appendix D)

Among 32 paints containing lead levels within the draft mandatory standard of no more than 100 ppm, prices ranged from 69 to 359 Thai baht (THB) per ¼ gallon. Among 51 paints containing lead levels above 100 ppm, prices ranged from 64 to 315 THB per ¼ gallon. (Table 3)

Moreover, the five most expensive paints (300-359 THB per ¼ gallon) contained lead levels ranging from < 5 to 47,000 ppm, while the five cheapest paints (64-88 THB per ¼ gallon) contained lead levels ranging from 9 to 21,000 ppm. The median price of 125 THB per ¼ gallon, lead content varied widely from <5 ppm to 54,000 ppm. (Table 4)

Table 3: Price comparison and lead content in ¼ gallon paints

	Paint Samples	Retail Volume	Lowest price	Highest price
Lead content ⩽ 100 ppm	32	¼ gallon	69 THB	359 THB
Lead content >100 ppm	51	¼ gallon	64 THB	315 THB
Total	83	¼ gallon		

Table 4: Lead content comparison among different price ranges

	Price	Retail Volume	Lowest Lead Level	Highest Lead Level
5 Most Expensive Paints	300-359 THB	¼ gallon	< 5 ppm	47,000 ppm
5 Cheapest Paints	64-88 THB	¼ gallon	9	21,000 ppm
Median Price of 83 Paints	125 THB	¼ gallon	< 5 ppm	54,000 ppm

3.4 Lead-free labeling

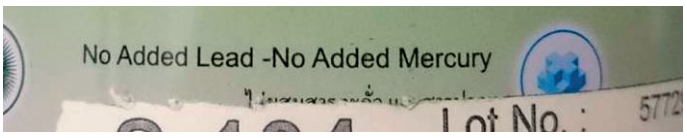
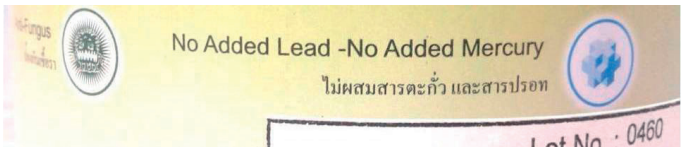
Of the paint samples with lead-free labeling in 2013 and 2015, fewer paints in 2015 were found to contain lead levels above 100 ppm. Among paints with lead-free labeling which were found to contain high content, most were first-party certification labels produced by manufacturers themselves. Only one paint sample contained lead content higher than the third-party certification standard issued by the Thai Industrial Standards Institute.

In 2013, approximately a quarter of the paint samples (37 of 120 paints) contained some form of lead-free labeling: either a first-party certification label by the manufacturers themselves claiming "No Added Lead" or "100% Lead-Free," or a third-party certification label by the Thai Industrial Standards Institute claiming to meet the voluntary standard of 600ppm (now reduced to 100ppm). The majority of these claims were found to be false advertising. For example, 17 of the 29 first-party certified products (59 percent) contained lead levels above 100 ppm, including 8 paints (28 percent) which contained dangerously high levels of lead above 10,000 ppm. In addition, 7 of 19 paints claiming to meet the voluntary standard (37 percent) actually contained lead levels higher than 600 ppm, and 5 paints (26 percent) that contained dangerously high levels of lead above 10,000 ppm.

In 2015, roughly the same proportion of paints (26 of 100 paints), or approximately a quarter of paint samples, were found to contain some form of lead-free labeling. The majority (16 paints) only displayed first-party certification claims of "No Added Lead." Some paints (6 paints) displayed both first-party certification claims and the Thai Industrial Standards Institute label. A minority of paints (4 paints) displayed only the TISI certification.

Compared to the 2013 study, however, fewer paints in 2015 were found to contain lead levels above 100 ppm. Six of the 26 paints (23 percent) with lead-free labeling contained lead levels above 100 ppm, including 4 paints (15 percent) which contained dangerously high lead levels exceeding 10,000 ppm, ranging from 26,000-59,000 ppm. Only one paint sample with the TISI third-party certification label contained lead above the certification limit of 100 ppm, with detected lead level of 740 ppm. (Table 5)

Table 5: Paints with lead-free labels containing high lead levels exceeding 10,000 ppm (2013-2015)

2015	2013
	
"No Added Mercury or Lead" Lead Content 59,000 ppm (THA 261) Denzo brand, produced by Thai TOA Industries	"No Added Mercury or Lead" Lead Content 56,000 ppm (THA 192) Denzo brand, produced by Thai TOA Industries
	
"No Added Mercury or Lead" Lead Content 32,000 ppm (THA 270) Kinzo brand, produced by Thai TOA Industries	"No Added Mercury or Lead" Lead Content 34,000 ppm (THA 194) Kinzo brand, produced by Thai TOA Industries
	
"No Added Mercury, No Added Lead" Lead Content 35,000 ppm (THA 307) Ben-Tone brand, produced by B.N. Brother	"No Added Mercury, No Added Lead" Lead Content 53,000 ppm (THA 108) Ben-Tone brand, produced by B.N. Brother
	
"No Added Lead - No Added Mercury" Lead Content 26,000 ppm (THA 290) - 2015 Sisto brand, produced by Sisson Paints (Thailand)	
	
"No Added Lead - No Added Mercury" Lead Content 49,000 ppm (THA 181) - 2013 Sisto brand, produced by Sisson Paints (Thailand)	

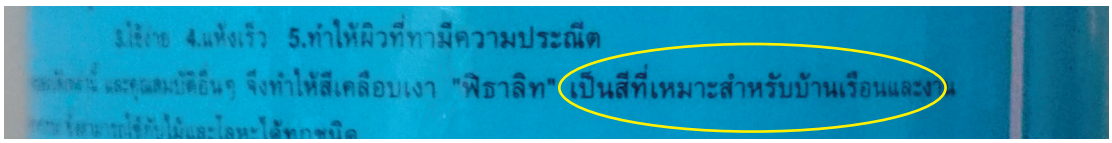
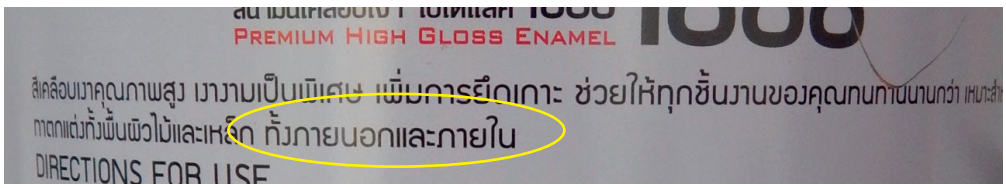
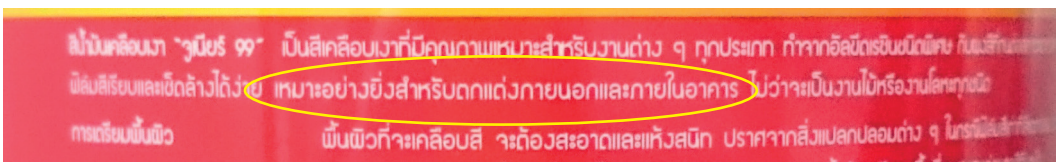
3.5 Continued used of leaded ingredients

Despite the positive trends of lead elimination and reduction in one third of paint manufacturers sampled, two thirds of paint manufacturers (24 manufacturers) analyzed in 2015 continue to produced leaded paints. Nineteen of these manufacturers are SMEs, three are manufacturers with no displayed company name, and two are large companies. Four of these SMEs are beginning to produce unleaded paints in some colors or in some brands. (Detailed analysis in Appendix C)

Despite proven capacity to produce unleaded paints, two large manufacturers continue to produce highly leaded paints, with detected lead levels of more than 10,000 ppm, and in some cases more than 100,000 ppm. These are large companies with international investment and foreign sales, namely, Nippon Paint (Thailand) and Thai Kansai Paint. The lead levels of paints produced by these two large companies vary widely, from < 5 to 110,000 ppm (Nippon Paint) and from 10 ppm to 112,000 ppm (Thai Kansai Paint). In addition, paint samples found to contain high lead levels produced by both companies indicate on can labels that these paints are “highly suitable for outdoor and indoor building decoration,” “suitable for decorative painting…both outdoor and indoor” and “suitable for the household.” (Table 6)

In addition, the study found three unnamed, unregistered paint manufacturers producing highly leaded paints. These paints contained high lead levels, ranging from 1,909-4,200ppm in white paints and 23,000-68,000ppm in bright color paints. Preventing the reuse of leaded ingredients in unregistered paint products will be a matter of increasing concern, as Thailand begins to phase out leaded paint.

Table 6: Examples of labels of paint products containing high lead levels


“This paint is suitable for household use…” Lead Content 112,000 ppm (THA 312) Ftalit brand, produced by Thai Kansai Paint

“suitable for decorative painting…both outdoor and indoor” Lead Content 110,000 ppm (THA 308) Bodelac 1000 brand, produced by Nippon Paint (Thailand)

“highly suitable for outdoor and indoor building decoration” Lead Content 71,000 ppm (THA 269) Junior 99 brand, produced by Nippon Paint (Thailand)

References

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2 EARTH. October 2013.

3 Department of Industrial Works. May 29, 2015.

4 In the manufacturing sector, small enterprises are defined as having no more than 50 employees or no more than 50 million baht in fixed assets, excluding land. Medium enterprises are defined as having 50-200 employees or more than 50 and less than 200 million baht in fixed assets, excluding land. Large enterprises are defined as having more than 200 employees or more than 200 million baht in fixed assets, excluding land. From Small and Medium Enterprise Development Bank of Thailand (SME Bank), 2012. www.smebank.co.th/en/definitions.php Accessed June 1, 2015.

5 EARTH, October 2013.

Conclusions and Recommendations

This study found that one-third of Thai paint manufacturers have begun to reduce or eliminated the use of leaded ingredients in enamel paint production, including many small and medium enterprises (SMEs). The reduction of leaded ingredients has no correlation with retail price regardless of paint color, suggesting that lead content is not a major factor in determining retail price and that the elimination of leaded ingredients from paint production is feasible for paint manufacturers without causing economic hardship.

The results of this study are in line with results of the *Survey of Small and Medium Enterprises (SMEs) on the Development of Mandatory Standard of Lead Content in Household Paint Products* by EARTH and the National Institute of Development Administration (NIDA) in July 2014. Of the 129 SME paint manufacturers surveyed, 95 percent of paint manufacturers were "willing to comply with a mandatory standard" and 80 percent were "ready to take measures to comply with a mandatory standard." SME paint manufacturers called on the Thai government to "issue clearer measures" because the existing voluntary standard "lacked enforcement authority." In addition, paint manufacturers called on the government to enforce the mandatory standard with effective inspection and strict penalties to prevent non-compliance and illegal import of non-compliant products from neighboring countries. Furthermore, paint manufacturers requested that the government provide technical support for SMEs in transition and provide information to raise the awareness of consumers and the general public on the importance of unleaded paint.[1]

Results of this 2015 study compared with the 2013 study by EARTH further indicate a decline in the advertisement of false labels, claiming products with high lead content to be lead-free. The majority of false labels that do remain in the market are self-certified claims produced by individual paint manufacturers themselves. In contrast, the majority of products with government-certified labels are unleaded, true to their claims. These findings suggest that while increased public awareness about the danger of lead paint may have influenced paint manufacturers to be more cautious against false advertisement, self-certified lead-free labels still lack enforcement authority compared to government-certified labels.

In light of these findings, EARTH recommends that the Thai government recognizes lead paint elimination as a priority and expedites the review process for the mandatory standard on lead content in enamel paints (TIS 2625-2557) to ensure the safety of consumers and Thai children.

References

1 EARTH and NIDA. July 2014.

Appendices

Appendix A:

Enamel Decorative Paints Purchased in Thailand and Analyzed for Lead Concentration, 100 samples

Appendix B:

Manufacturers found to have reduced or removed leaded ingredients in some or all brands/colors, compared to samples from previous studies

Appendix C:

Manufacturers found to continue producing leaded paints with no change, compared to previous studies

Appendix D:

Price and lead content, comparison among ¼ gallon paints

Appendix A: *Enamel Decorative Paints Purchased in Thailand and Analyzed for Lead Concentration, 100 samples*

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
1	THA 305	B.N. Brother	Beger Cool *mixed on-site	Sulphur yellow 7160	0.946L	359	050814	140724203331	12.01.2015	"No Added Lead No Added Mercury"	-	< 10
2	THA 306	B.N. Brother	Beger Delight Titanium	Reddish yellow G6303	3.785L	530	230914	140912204120	12.01.2015	" No Added Lead No Added Mercury"	TIS 327-2553	95
3	THA 344	B.N. Brother	Beger Shield	White B-100	0.946L	180	210314	140314201309	10.01.2015	" No Added Lead No Added Mercury"	-	< 5
4	THA 253	B.N. Brother	Beger Shield	Sulphur Yellow B-160	0.85L	300	140714	140707203008	22.11.2014	" No Added Lead No Added Mercury"	TIS 327-2553	40
5	THA 340	B.N. Brother	Ben-Tone	White G101	3.5L	390	061114	141028204981	12.01.2015	" No Added Lead No Added Mercury"	-	< 5
6	THA 307	B.N. Brother	Ben-Tone	Signal red G404	0.875L	140	070711	115457	12.01.2015	" No Added Lead No Added Mercury"	-	35,000
7	THA 336	Berger Paint (Thailand)	PLATONG	White 399	0.875L	110	11/11/2014	-	10.01.2015	-	-	1,423
8	THA 283	Berger Paint (Thailand)	PLATONG	Yellow 380	3.5L	360	15032014	-	18.11.2014	-	-	47,000
9	THA 257	Captain Coating	Captain *mixed on-site	Temple Yellow 311	0.946L	346	-	1410221065	22.11.2014	" No Added Lead No Added Mercury"	-	< 5
10	THA 258	Captain Coating	Captain	Temple Yellow 00311	0.946L	190	-	1406219231	22.11.2014	" No Added Lead No Added Mercury"	-	< 5

*"Mixed onsite" indicates paints that are sold by mixing pigments according to order on-site at the time and place of purchase

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
11	THA 274	Captain Industry	Longlife	Yellow 2300	0.946L	160	-	24608136	22.11.2014	-	TIS 327-2553	47
12	THA 278	Captain Coating	MARK	Reddish Yellow OM831	3.5L	355	-	1408220056	23.11.2014	-	-	< 5
13	THA 260	Delta Paint	DELTA	Sunflower 303	0.946L	152	06-2014	572010437	18.11.2014	-	TIS 327-2553	740
14	THA 335	Delta Paint	DELTA	White 700	0.946L	152	12-2014	572010751	10.01.2015	-	TIS 327-2553	< 5
15	THA 265	Delta Paint	IBC	Lemon Yellow 434	0.875L	150	03-2008	102221	22.11.2014	-	-	12,100
16	THA 280	Delta Paint	National	Tangerine 401	0.875L	120	08-2014	572021116	23.11.2014	-	-	24,284
17	THA 316	Delta Paint	National	Lemon yellow 301	0.875L	139	02-2010	111059 02-2010	12.01.2015	-	-	41,000
18	THA 378	Delta Paint	National	White	0.875L	120	05-2014	572020525	10.01.2015	-	-	< 5
19	THA 263	DYNO Paint	DYNO Pro	Bright Yellow G*115	0.946L	245	080514	S14050812	22.11.2014	-	-	55,480
20	THA 285	DYNO Paint (under license from Rust-Oleum)	Rust-Oleum	Safety Yellow 944	0.946L	315	300614	D1463012	22.11.2014	-	-	47,000

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
21	THA 276	Hachem Paint	LOTTO	Sunflower L-1303	0.825L	120	120213	130368	22.11.2014	-	-	46,000
22	THA 320	Hachem Paint	LOTTO	White L-100	0.825L	120	2.12.14	144107	10.01.2015	-	-	< 5
23	THA 275	Hachem Paint	LOTTO	White L-100	0.825L	120	191014	142144	22.11.2014	-	-	< 5
24	THA 329	Hato Paint (J.K.R.)	HATO	White N-341	0.8L	120	06.03.14	1403-15997-N-341	10.01.2015	-	-	< 5
25	THA 352	Hato Paint (J.K.R.)	HATO	Yellow N344	0.80L	120	23.01.14	1401-15306-N-344	10.01.2015	-	-	61,000
26	THA 264	Hato Paint (J.K.R.)	HATO	Yellow	0.3L	36	03/07/14	n/a	13.12.2014	-	-	69,000
27	THA 338	Hato Paint (J.K.R.)	N.O.C	White S2600	0.875L	100	31.07.14	1407-18713-S-2600	10.01.2015	-	-	< 10
28	THA 279	Hato Paint (J.K.R.)	N.O.C	Yellow S234	3.5L	320	06/03/2014	1407 - 16XXX - S-234	10.12.2014	-	-	54,000
29	THA 325	IEC Paint Thailand	IEC	White A-100	0.946L	150	n/a	n/a	14.01.2015	-	-	6,300
30	THA 266	IEC Paint Thailand	IEC	Sunspot A-177	0.3L	50	n/a	n/a	29.11.2014	-	-	24,000

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
31	THA 259	JBP International Paint	Columbia	Marigold 2227	0.875L	140	01.03.13	36/52	29.11.2014	-	-	29,000
32	THA 323	JBP International Paint	JBP	White 001	1/4 Gallon	155	01.10.14	31/601	14.01.2015	" No Added Lead No Added Mercury"	-	< 5
33	THA 267	JBP International Paint	JBP	Golden Yellow 003	0.946L	180	07.09.11	31/708	22.11.2014	-	-	79,000
34	THA 319	KOSMIK Polymer	Super-K	S-222 Purple	0.875L	150	n/a	26034	12.01.2015	-	-	4,639
35	THA 250	LENA (Thailand)	6-B	White T-400	1/4 Gallon	88	230614	14060506	10.12.2014	-	-	2,000
36	THA 251	LENA (Thailand)	6-B	Reddish Yellow T-317	1/4 Gallon	88	060114	14010009	10.12.2014	-	-	21,000
37	THA 301	LENA (Thailand)	6-B (Red Oxide Primer)	Grey	1/4 Gallon	64	110914	14090716	10.12.2014	-	-	189
38	THA 375	LENA (Thailand)	BUNDAI	Sky white D011	0.946L	145	14.08.00 (old paint)	n/a	12.01.2015	-	-	2,882
39	THA 376	LENA (Thailand)	BUNDAI	Sulfur yellow D160	0.946L	145*	16.08.00 (old paint)	n/a	12.01.2015	-	-	50,000
40	THA 379	LENA (Thailand)	BUNDAI	Reddish yellow D155	750 G	150*	n/a	7080854	12.01.2015	-	-	31,000

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
41	THA 256	LENA (Thailand)	BUNDAI	Reddish Orange D 159	0.875L	150	030611	11060476	22.11.2014	-	-	24,000
42	THA 272	LENA (Thailand)	LENA	Red	0.3L	150	n/a	n/a	22.11.2014	-	-	1,460
43	THA 293	LEO Paint	TIGER	Bright Silver	0.875L	120	241114	n/a	29.11.2014	-	-	60
44	THA 310	Maneekarn Paint	D.I.Y.	Butter cup 175 (yellow)	0.75L	125	03.12.12	n/a	12.01.2015	-	-	54,000
45	THA 333	Maneekarn Paint	D.I.Y.	White 100	0.75L	125	15.11.14	n/a	12.01.2015	-	-	< 5
46	THA 330	MAXZO Paint	SUPERSEF	White G1000	0.9L	140	24.11.14	5707441#050	12.01.2015	-	-	1,631
47	THA 317	MAXZO Paint	SUPERSEF	Yellow G2103	0.9L	140	n/a	5502404#002	12.01.2015	-	-	66,000
48	THA 252	N/A (1)	APPLE	Flame Red 333	1 Pound	40	n/a	n/a	13.12.2014	-	-	23,000
49	THA 289	N/A (2)	SEFCO	Sulphur Yellow S-160	0.85L	120	09/2013	18698	18.11.2014	-	-	68,000
50	THA 334	N/A (2)	SEFCO	White	0.75L	100	09/2014	24872	10.01.2015	-	-	1,909

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
51	THA 324	N/A (3)	TOWN	401 ณชIVORY	3 L	395	18.06.13	n/a	14.01.2015	-	-	4,200
52	THA 315	Nakoya Paint (Thailand)	Nakoya	Lemon drop 7752	0.875L	110	n/a	070118	12.01.2015	-	-	50,000
53	THA 297	Nam Dee Watana Chemical	TURBO	Reddish Orange G 2159	0.9L	150	13.3.13	1303127	23.11.2014	-	-	20,423
54	THA 254	Nippon Paint (Thailand)	BODELAC 9000	Canary 124	0.946L	326	28.07.2014	20140721	22.11.2014	-	-	< 5
55	THA 255	Nippon Paint (Thailand)	BODELAC 9000	White	0.946L	219	16.09.2014	20140905	10.12.2014	-	-	< 5
56	THA 269	Nippon Paint (Thailand)	Junior 99	Red 9707	0.875L	98	25.07.2014	20140718	10.12.2014	-	-	71,000
57	THA 268	Nippon Paint (Thailand)	Junior 99	White 9700	0.875L	98	09.09.2014	20140902	10.12.2014	-	-	2,218
58	THA 308	Nippon Paint (Thailand)	BODELAC 1000	Yellow 124	3.785L	565	13.02.2012	20120201	14.01.2015	-	-	110,000
59	THA 339	Nippon Paint (Thailand)	BODELAC 9000	White 900	0.946L	220	05.08.2010	n/a	10.01.2015	-	TIS 327-2538	< 5
60	THA 287	P.M. Paint	Seal-Jacob	Lemon Yellow S434	0.75L	90	030614	14060122	10.12.2014	-	-	27,000

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
61	THA 288	P.M. Paint	Seal-Jacob	White S111	0.75L	90	180914	14090441	10.12.2014	-	-	1,490
62	THA 318	PPM Commercial	VICTOR	Yellow orange P-444	0.90 KG	145	n/a	14441682	12.01.2015	-	-	52,000
63	THA 322	PPM Commercial	VICTOR	White P-111	0.90 KG	145	n/a	41111055	12.01.2015	-	-	< 10
64	THA 299	Sahatat	XEN	Sunspot 177	0.9 L	120	n/a	0780956	29.11.2014	-	-	13,937
65	THA 343	Sahatat	XEN	White 100	0.9L	150	n/a	1431057	10.01.2015	-	-	2,495
66	THA 342	SEFCO Chemical (2001)	Y2K SEFCO	White Y100	0.850L	100	10/2014	25338	12.01.2015	-	-	1,686
67	THA 300	SEFCO Chemical (2001)	Y2K SEFCO	Sulphur Yellow Y2160	0.85L	120	02/2012	07738	23.11.2014	-	-	51,000
68	THA 290	Sisson Paints (Thailand)	SISTO	Yellow Orange S-104	0.825L	130	n/a	577293	14.12.2014	“ No Added Lead No Added Mercury”	-	26,000
69	THA 282	T Paint (under license from British Paints)	PAMMASTIC	Lemon Yellow SE 301	3.785L	549	n/a	140321101	14.12.2014	“ No Added Lead No Added Mercury”	TIS 327-2553	46
70	THA 281	T Paint (under license from British Paints)	PAMMASTIC	Super White SE100	3.785L	549	n/a	141030101	14.12.2014	“ No Added Lead No Added Mercury”	TIS 327-2553	46

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
71	THA 284	T Paint (under license from British Paints)	Rocket	Scarlet Orange RE-401	0.875L	92	n/a	140822101	10.12.2014	" No Added Lead No Added Mercury"	-	53
72	THA 309	Taveepaibul	COMPAC	Sulphur yellow	3.785L	390	n/a	200255 /120377	12.01.2015	-	-	37,000
73	THA 337	Taveepaibul	COMPAC	White 100	0.946L	120	n/a	507236/131958	12.01.2015	-	-	3,800
74	THA 298	Taveepaibul	TVB	Reddish Yellow T-420	0.946L	130	n/a	509057142663	13.12.2014	-	-	36,000
75	THA 377	Thai Kansai Paint	FTALIT	White 531	0.946L	170	7.03.2014	4020173	12.01.2015	-	-	10
76	THA 312	Thai Kansai Paint	FTALIT	Lemon yellow 581	0.946L	170	29.09.11	1090420	12.01.2015	-	-	112,000
77	THA 348	Thai TOA Industries	DENZO	White D600	0.85L	110	n/a	101057986501	10.01.2015	"100% Lead-Free"	-	< 5
78	THA 261	Thai TOA Industries	DENZO	Yellow D-612	0.85L	120	n/a	n/a	10.12.2014	" No Added Lead No Added Mercury"	-	59,000
79	THA 321	Thai TOA Industries	KINZO	White K700	0.85L	110	n/a	n/a	10.01.2015	"100% Lead-Free"	-	210
80	THA 270	Thai TOA Industries	KINZO	Medium Yellow K-757	0.85L	120	n/a	135462501	29.11.2014	" No Added Lead No Added Mercury"	-	32,000

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
81	THA 313	ThongThai (Paints Industry)	HUNTER	Sulfur yellow 242	0.75L	100	n/a	1 6337	12.01.2015	-	-	42,000
82	THA 292	TKS Chemical (Thailand)	TEMCO	Reddish Yellow T-317	0.8L	120	n/a	0160814	23.11.2014	-	-	27,736
83	THA 328	TKS Chemical (Thailand)	TEMCO	White T400	0.8L	120	120614	n/a	10.01.2015	-	-	2,660
84	THA 327	TKS Chemical (Thailand)	TEMCO	White T400	0.8L	120	231214	n/a	12.01.2015	-	-	4,860
85	THA 326	TOA Paint (Thailand)	HOMECOTE	White H100	0.875L	110	n/a	140322101	12.01.2015	-	-	< 5
86	THA 349	TOA Paint (Thailand)	KOBE	White K500	0.875L	100	n/a	140403101	10.01.2015	-	-	< 5
87	THA 271	TOA Paint (Thailand)	KOBE	Tangerine K206	0.875 L	130	n/a	140407101	29.11.2014	-	-	108
88	THA 302	TOA Paint (Thailand)	KOBE Red Oxide Primer	Red	0.875L	70	n/a	140121101	10.12.2014	-	-	9
89	THA 345	TOA Paint (Thailand)	Mandarin Duck	White M111	0.875L	139	n/a	141013101	12.01.2015	-	-	< 5
90	THA 277	TOA Paint (Thailand)	Mandarin Duck	Yellow Orange M 444	0.875L	92	n/a	141029101	10.12.2014	-	-	< 5

No.	Sample No.	Manufacturer	Brand	Color	Can Size	Purchase Price (Thai Baht)	Date of Manufacture	Lot Number	Date of Purchase (dd. mm.yyyy)	Lead-Free Certification by Manufacturer	Thai Industrial Standard Certification	Lead Concentration (ppm)
91	THA 303	TOA Paint (Thailand)	Mandarin Duck Grey Primer	Grey	0.875L	69	n/a	141016101	10.12.2014	-	-	97
92	THA 291	TOA Paint (Thailand)	SUPERMATEX	Butter Cup MX2175	3.785 L	385	n/a	140515101	29.11.2014	" No Added Lead No Added Mercury"	TIS 327-2553	< 5
93	THA 332	TOA Paint (Thailand)	SUPERMATEX	White MX1000	3.785L	380	n/a	Batch no. 140908101	12.01.2015	" No Added Lead No Added Mercury"	TIS 327-2553	< 5
94	THA 351	TOA Paint (Thailand)	TOA Glipton	White G100	0.946L	170	n/a	141008102	10.01.2015	" No Added Lead No Added Mercury"	-	< 5
95	THA 294	TOA Paint (Thailand)	TOA Glipton	Coral Red G 643	0.946L	150	n/a	130905101	22.11.2014	" No Added Lead No Added Mercury"	-	24
96	THA 296	TOP Paint Perfect	TOP	White T-1111	0.8L	130	15/10/14	EN5710051	10.12.2014	-	-	210
97	THA 295	TOP Paint Perfect	TOP	Yellow Orange T-1444	0.8L	130	17/09/14	EN5709069	10.12.2014	-	-	72,000
98	THA 273	U.R. Chemical	Lobster	Yellow	0.28L	50	n/a	n/a	18.11.2014	-	-	2,800
99	THA 350	U.R. Chemical	Lobster	White 900	0.875L	110	n/a	n/a	10.01.2015	" No Added Lead No Added Mercury"	-	< 5
100	THA 286	V. Brother Industry	SAMLAC	Yellow SL 612	0.8L	120	6.5.11	030811	23.11.2014	-	-	40,000

ppm = Parts Per Million

Appendix B: *Manufacturers found to have reduced or removed leaded ingredients in some or all brands/colors, compared to samples from previous studies*

1. B.N. Brother

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
1	Beger Cool (mixed on-site)	THA 305	Sulphur yellow 7160	05.08.14	140724203331	< 10	-	-	-	-	-
2	Beger Delight Titanium	THA 306	Reddish yellow G6303	23.09.14	140912204120	95	THA 104	Reddish yellow G6303	27.06.11	115454	43,000
3	Beger Shield	THA 253	Sulphur yellow B-160	14.07.14	140707203008	40	THA 105	Sulphur yellow B160	8.07.11	115897	48,000
4	Beger Shield	THA 344	White B-100	21.03.14	140314201309	< 5	THA 107	Primrose white B008	n/a	n/a	25
5	Ben-Tone	THA 307	Signal red G404	07.07.11	115457	35,000	-	-	-	-	-
6	Ben-Tone	THA 340	White G101	6.11.14	141028204981	< 5	THA 109	White G101	31.10.12	123002004277	4,000

2. Captain Coating

No.	Brand	2015					2010, 2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
7	Captain (mixed on-site)	THA 257	Temple Yellow 311	n/a	1410221065	< 5	THA 114	Temple Yellow 311	20.02.13	Base D 13012114	390
8	Captain	THA 258	Temple Yellow 00311	n/a	1406219231	< 5	THA 114	Temple Yellow 311	20.02.13	Base D 13012114	390
9	Longlife	THA 274	Yellow 2300	n/a	24608136	47	THA 2010-08	Sunflower 2309	n/a	25108008	1,113
10	MARK	THA 278	Reddish Yellow OM831	n/a	1408220056	< 5	THA 115	Reddish Yellow 0M831	n/a	1210209969	3,800

3. Delta Paint

No.	Brand	2015					2010, 2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
11	DELTA	THA 260	Sunflower 303	06.2014	572010437	740	THA 2010-11	Sunflower 303	05.2010	102248	13,207
12	DELTA	THA 335	White 700	12.2014	572010751	< 5	THA 121	Cool White 810	11.2012	552010648	280
13	IBC	THA 265	Lemon Yellow 434	03.2008	102221	12,100	TH 122	Yellow Orange 444	02.2007	101939	27,000
14	National	THA 280	Tangerine 401	08.2014	572021116	24,284	-	-	-	-	-
15	National	THA 316	Lemon yellow 301	02.2010	111059	41,000	THA 118	Sunflower 303	05.2007	108220	32,000
16	National	THA 378	White	05.2014	572020525	< 5	THA 119	White 101	11.2012	552021492	9

4. Hachem Paint

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
17	LOTTO	THA 276	Sunflower L-1303	12.02.13	130368	46,000	THA 159	Reddish Yellow L-1155	6.9.10	104325	39,000
18	LOTTO	THA 320	White L-100	2.12.14	144107	< 5	THA 133	White L-100	15/12/....	114938	1,780
19	LOTTO	THA 275	White L-100	19.10.14	142144	< 5	THA 133	White L-100	15/12/....	114938	1,780

5. Hato Paint (J.K.R.)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
20	HATO	THA 329	White N-341	06.03.14	1403-15997-N-341	< 5	THA 138	White	n/a	n/a	4,000
21	HATO	THA 352	Yellow N344	23.01.14	1401-15306-N-344	61,000	THA 137	Yellow	n/a	n/a	86,000
22	HATO	THA 264	Yellow	03.07.14	n/a	69,000	THA 137	Yellow	n/a	n/a	86,000
23	N.O.C.	THA 338	White S2600	31.07.14	1407-18713-S-2600	< 10	THA 136	White S-2600	03.09.12	1208-6364-S-2600	4,200
24	N.O.C.	THA 279	Yellow S234	06.03.14	1403-16xxx-S-234	54,000	THA 135	Yellow S234	12.11.2012	1211-7645-S-234	56,000

6. J.B.P. International Paint

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
25	Columbia	THA 259	Marigold 2227	01.03.13	36/52	29,000	THA 144	Marigold 2227	19.07.11	36/246	34,000
26	JBP	THA 323	White 001	01.10.14	31/601	< 5	THA 141	White 001	20.08.12	31/573	156
27	JBP	THA 267	Golden Yellow 003	07.09.11	31/708	79,000	TH 140	Golden Yellow 003	06.08.12	31/538	87,000

7. Maneekarn Paint

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
28	D.I.Y.	THA 310	Buttercup 175	03.12.12	n/a	54,000	THA 160	Buttercup 175	070809	n/a	60,000
29	D.I.Y.	THA 333	White 100	15.11.14	n/a	< 5	THA 161	White 100	04.05.12	n/a	310

8. PPM Commercial

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
30	VICTOR	THA 318	Yellow orange P444	n/a	14441682	52,000	THA 175	Lemon Yellow P434	n/a	24340549	63,000
31	VICTOR	THA 322	White P-111	n/a	41111055	< 10	THA 176	White-P111	n/a	21111360	4,400

9. T. Paint (under license from British Paints)

No.	Brand	2015					2013 (unless otherwise noted)				
		Sample No.	Color	Date of anufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of anufacture	Lot No.	Lead Concentration (ppm)
32	Rocket	THA 284	Scarlet Orange RE 401	n/a	140822101	53	THA 213	Yellow Orange RE 301	n/a	111201101	18,300
33	PAMMASTIC	THA 282	Lemon Yellow SE 301	n/a	140321101	46	-	-	-	-	-
34	PAMMASTIC	THA 281	Super White SE 100	n/a	141030101	46	-	-	-	-	-

10. TOA Paint (Thailand)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
35	Homecote	THA 326	White H100	n/a	140322101	< 5	THA 202	White H100	n/a	130111101	490
36	KOBE	THA 271	Tangerine K206	n/a	140407101	108	-	-	-	-	-
37	KOBE	THA 349	White K500	n/a	140403101	< 5	THA 204	White	n/a	130212101	22
38	KOBE Red Oxide Primer	THA 302	Red	n/a	140121101	9	-	-	-	-	-
39	Mandarin Duck	THA 345	White M111	n/a	141013101	< 5	THA 206	White M111	n/a	121115102	<9
40	Mandarin Duck	THA 277	Yellow Orange M 444	n/a	141029101	< 5	-	-	-	-	-
41	Mandarin Duck Grey Primer	THA 303	Grey	n/a	141016101	97	-	-	-	-	-
42	SUPERMATEX	THA 291	Butter Cup MX-2175	n/a	140515101	< 5	-	-	-	-	-
43	SUPERMATEX	THA 332	White MX-1000	n/a	140908101	< 5	THA 212	White MX-1000	n/a	120601101	164
44	TOA Glipton	THA 351	White G100	n/a	141008102	< 5	THA 209	White G100	n/a	120809101	52
45	TOA Glipton	THA 294	Coral Red G643	n/a	130905101	24	-	-	-	-	-

11. U.R. Chemical (Thailand)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
46	Lobster	THA 273	Yellow	n/a	n/a	2,800	THA 214	Yellow	n/a	11/09/21-0310 LT21#909	28,000
47	Lobster	THA 350	White 900	n/a	141101-0110 LT13#9014:14	< 5	THA 215	White	n/a	n/a	61

Appendix C: *Manufacturers found to continue producing leaded paints with no change, compared to previous studies*

1. Berger Paints (Thailand)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
1	PLATONG	THA 283	Yellow 380	15032014	-	47,000	THA 111	Medium Yellow -380	29/06/2012	1206724	63,000
2	PLATONG	THA 336	White 399	11112014	-	1,423	THA 112	White 399	11/01/2013	1300426 399	1,710

2. DYNO Paint

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
3	DYNO Pro	THA 263	Bright Yellow G*115	080514	S14050812	55,480	THA 129	Bright Yellow G*115	180113	S13011810	31,000
4	Rust-Oleum	THA 285	Safety Yellow 944	300614	D1463012	47,000	THA 127	Safety Yellow 944	250112	D1212405	95,000

3. IEC Paint Thailand

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
5	IEC	THA 266	Sunspot A-177	n/a	n/a	24,000	THA 139	Sunspot A-177	n/a	n/a	51,000
6	IEC	THA 325	White A-100	n/a	n/a	6,300	-	-	-	-	-

4. KOSMIK Polymer

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
7	Super-K	THA 319	S-222 Purple	n/a	26034	4,639	THA 149	Parade Blue SK 303	n/a	109025	26

5. LENA (Thailand)

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
8	LENA	THA 272	Red	n/a	n/a	1,460	-	-	-	-	-
9	BUNDAI	THA 379	Reddish yellow D155	n/a	7080854	31,000	THA 150	Reddish yellow D155	170708	8070664	14,200
10	BUNDAI	THA 376	Sulfur yellow D160	16.08.10 (old paint)	n/a	50,000	-	-	-	-	-
11	BUNDAI	THA 256	Reddish Orange D 159	030611	11060476	24,000	-	-	-	-	-
12	BUNDAI	THA 375	SKY white D011	14.08.10 (old paint)	-	2,882	THA 151	White D100	220113	13010079	3,100
13	6-B	THA 251	Reddish Yellow T-317	060114	14010009	21,000	-	-	-	-	-
14	6-B	THA 250	White T-400	230614	14060506	2,000	-	-	-	-	-
15	6-B (Red Oxide Primer)	THA 301	Grey	110914	14090716	189	-	-	-	-	-

6. LEO Paint

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
16	TIGER	THA 293	Bright Silver	241114	n/a	60	THA 158	Zircon Blue 834	10.08.09	n/a	4,500

7. MAXZO Paint

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
17	SUPERSEF	THA 317	Yellow G2103	n/a	5502404#002	66,000	THA 162	Yellow G2103	n/a	5501166#001	63,000
18	SUPERSEF	THA 330	White G1000	n/a	5707441#050	1,631	THA 163	White G1000	n/a	5512263	2,700

8. Nakoya Paint (Thailand)

No.	Brand	2015					2010 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
19	Nakoya	THA 315	Lemon drop 7752	n/a	070618	50,000	THA 2010 -30	Yellow 904	n/a	n/a	28,084

9. Nam Dee Watana Chemical

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
20	TURBO	THA 297	Reddish Orange G 2159	13.3.13	1303127	20,423	THA 168	Reddish Orange G 2159	25-9-12	1209283	9,800

10. Nippon Paint (Thailand)

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same brands not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
21	BODELAC 9000	THA 254	Canary 124	28.07.2014	20140721	< 5	-	-	-	-	-
22	BODELAC 9000	THA 339	White 900	05.08.2010	n/a	< 5	-	-	-	-	-
23	BODELAC 9000	THA 255	White	16.09.2014	20140905	< 5	-	-	-	-	-
24	BODELAC 1000	THA 308	Yellow 124	13.02.2012	20120201	110,000	THA 170	Yellow 124	25.06.2007	20070618	22,000
25	Junior 99	THA 269	Red 9707	25.07.2014	20140718	71,000	-	-	-	-	-
26	Junior 99	THA 268	White 9700	09.09.2014	20140902	2,218	-	-	-	-	-

11. P.M. Paint

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
27	Seal-Jacob	THA 287	Lemon Yellow S434	030614	14060122	27,000	-	-	-	-	-
28	Seal-Jacob	THA 288	White S111	180914	14090441	1,490	-	-	-	-	-

12. Sahatat

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
29	XEN	THA 299	Sunspot 177	n/a	0780956	13,937	THA 179	Butter Cup 175	n/a	0802655	5,300
30	XEN	THA 343	White 100	n/a	1431057	2,495	THA 180	White 100	n/a	0710156	3,300

13. SEFCO Chemical (2001)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
31	Y2K SEFCO	THA 300	Sulphur Yellow Y2160	02/2012	07738	51,000	THA 184	Sulphur Yellow Y2160	05.08	61047	46,000
32	Y2K SEFCO	THA 342	White Y100	10/2014	25338	1,686	THA 183	White Y100	01/2013	13960	2,100

14. Sisson Paints (Thailand)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
33	SISTO	THA 290	Yellow Orange S-104	n/a	577293	26,000	THA 181	Sulphur Yellow S-103	n/a	0460	49,000

15. Taveepaibul

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
34	TVB	THA 298	Reddish Yellow T-420	n/a	509057142663	36,000	THA 189	Reddish Yellow T-420	260511	111402	45,000
35	COMPAC	THA 309	Sulphur yellow	n/a	200255 /120377	37,000	-	-	-	-	-
36	COMPAC	THA 337	White 100	n/a	507236/131958	3,800	-	-	-	-	-

16. Thai Kansai Paint

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
37	FTALIT	THA 312	Lemon yellow 581	29.09.11	1090420	112,000	THA 190	Lemon Yellow 581	25.06.2010	0061085	50,000
38	FTALIT	THA 377	White 531	7.03.2014	4020173	10	THA 191	White 531	1/2/12	2010879	23

17. Thai TOA Industries

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
39	DENZO	THA 261	Yellow D-612	n/a	n/a	59,000	THA 192	Yellow D-612	14.2.12	466302	56,000
40	DENZO	THA 348	White D600	n/a	101057986501	< 5	THA 193	White D600	80113	374201	12
41	KINZO	THA 270	Medium Yellow K-757	n/a	135462501	32,000	TH 194	Yellow K-712	171008	655601	34,000
42	KINZO	THA 321	white K700	n/a	50357455101	210	THA 195	Flat White K-744	11 3 2011	680601	181

18. Thong Thai (Paints Industry)

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
43	HUNTER	THA 313	Sulfur yellow 242	n/a	1 6337	42,000	THA 197	Brown yellow 240	n/a	6081	20,000

19. T.K.S. Chemical (Thailand)

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
44	TEMCO	THA 292	Reddish Yellow T-317	n/a	0160814	27,736	THA 187	Pel Ivory T312 (Yellow)	n/a	005022	6,800
45	TEMCO	THA 327	White T400	n/a	231214	4,860	THA 188	White T400	n/a	001013	4,100
46	TEMCO	THA 328	White T400	n/a	120614	2,660	THA 188	White T400	n/a	001013	4,100

20. TOP Paint Perfect

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
47	THA 295	TOP	Yellow Orange T-1444	17/09/14	n/a	72,000	-	-	-	-	-
48	THA 296	TOP	White T-1111	15/10/14	n/a	210	-	-	-	-	-

21. V. Brother Industry

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
49	SAMLAC	THA 286	Yellow SL 612	6.5.11	030811	40,000	THA 216	Yellow SL 612	18.03.2010	170510	14,900

22. N/A (1) - unidentified manufacturer

No.	Brand	2015					2013 - insufficient data to conclude change in lead use (same colors not available)				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
50	APPLE	THA 252	Flame Red 333	-	-	23,000	THA-2010-29	Yellow orange	8.11.2010	n/a	34,442

23. N/A (2) - unidentified manufacturer

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
51	SEFCO	THA 289	Sulphur Yellow S-160	09/2013	09/2013 18698	68,000	THA 164	Reddish Yellow S 155	02/2012	07449	44,000
52	SEFCO	THA 334	White	09/2014	24872	1,909	THA 165	White S100	40299	n/a	1,820

24. N/A (3) - unidentified manufacturer

No.	Brand	2015					2013 - same color or closest shade available				
		Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)	Sample No.	Color	Date of Manufacture	Lot No.	Lead Concentration (ppm)
53	TOWN	THA 324	401 ณชIVORY	18.06.13	n/a	4,200	-	-	-	-	-

Appendix D: Price and lead content, comparison among ¼ gallon paints

Lead Concentration (ppm)	Purchase Price (Thai baht)	Manufacturer	Brand	Color	Lead-Free Label by Manufacturer	Thai Industrial Standards	Sample No.
< 5	180	B.N. Brother	Beger Shield	White B-100	No Added Lead No Added Mercury	-	THA 344
< 5	346	Captain Coating	Captain (mixed on-site)	Temple Yellow 311	No Added Lead No Added Mercury	-	THA 257
< 5	190	Captain Coating	Captain	Temple Yellow 00311	No Added Lead No Added Mercury	-	THA 258
< 5	120	Delta Paint	National	White	-	-	THA 378
< 5	152	Delta Paint	DELTA	White 700	-	TIS 327-2553	THA 335
< 5	120	Hachem Paint	LOTTO	white L-100	-	-	THA 320
< 5	120	Hachem Paint	LOTTO	White L-100	-	-	THA 275
< 5	120	HATO Paint	HATO	White N-341	-	-	THA 329
< 5	155	JBP International Paint	JBP	White 001	No Added Lead No Added Mercury	-	THA 323
< 5	125	Maneekarn Paint	D.I.Y.	White 100	No	-	THA 333
< 5	220	Nippon Paint (Thailand)	BODELAC 9000	White 900	No	TIS 327-2538	THA 339
< 5	326	Nippon Paint (Thailand)	BODELAC 9000	Canary 124	No.	-	THA 254
< 5	219	Nippon Paint (Thailand)	BODELAC 9000	White	No.	-	THA 255
< 5	110	Thai TOA Industries	DENZO	White D600	100% Lead Free	-	THA 348
< 5	139	TOA Paint (Thailand)	Mandarin duck	White M111	-	-	THA 345
< 5	100	TOA Paint (Thailand)	KOBE	White K500	-	-	THA 349
< 5	170	TOA Paint (Thailand)	TOA Glipton	White G100	No Added Lead No Added Mercury	-	THA 351
< 5	110	TOA Paint (Thailand)	Homecote	White H100	-	-	THA 326
< 5	92	TOA Paint (Thailand)	Mandarin Duck	Yellow Orange M444	-	-	THA 277

Lead Concentration (ppm)	Purchase Price (Thai baht)	Manufacturer	Brand	Color	Lead-Free Label by Manufacturer	Thai Industrial Standards	Sample No.
< 5	110	U.R. Chemical (Thailand)	Lobster	White 900	No Added Lead No Added Mercury	-	THA 350
9	70	TOA Paint (Thailand)	KOBE (Red Oxide Primer)	Red	-	-	THA 302
< 10	359	B.N. Brother	Beger Cool (mixed on-site)	Sulphur yellow 7160	No Added Lead No Added Mercury	-	THA 305
< 10	100	HATO Paint	N.O.C	White S2600	-	-	THA 338
< 10	145	PPM Commercial	VICTOR	White P-111	-	-	THA 322
10	170	Thai Kansai Paint	FTALIT	White 531	-	-	THA 377
24	150	TOA Paint (Thailand)	TOA Glipton	Coral Red G 643	No Added Lead No Added Mercury	-	THA 294
40	300	B.N.Brother	Beger Shield	Sulphur Yellow B-160	No Added Lead No Added Mercury	TIS 327-2553	THA 253
47	160	Captain Industry	Longlife	Yellow 2300	No.	TIS 327-2538	THA 274
53	92	T Paint (under license from British Paints)	Rocket	Scarlet Orange RE-401	No Added Lead No Added Mercury	-	THA 284
60	120	LEO Paint	TIGER	Bright Silver	-	-	THA 293
97	69	TOA Paint (Thailand)	Mandarin Duck Primer	Grey	-	-	THA 303
108	130	TOA Paint (Thailand)	KOBE	Tangerine K206	-	-	THA 271
189	64	LENA (Thailand)	6-B (Red Oxide Primer)	Grey	-	-	THA 301
210	110	Thai TOA Industries	KINZO	White K700	100% Lead-Free	-	THA 321
210	130	TOP Paint Perfect	TOP	White T-1111	-	-	THA 296
740	152	Delta Paint	DELTA	Sunflower 303	-	TIS 327-2553	THA 260
1,423	110	Berger Paint (Thailand)	PLATONG	White 399	-	-	THA 336

Lead Concentration (ppm)	Purchase Price (Thai baht)	Manufacturer	Brand	Color	Lead-Free Label by Manufacturer	Thai Industrial Standards	Sample No.
1,490	90	P.M. Paint	Seal-Jacob	White S111	-	-	THA 288
1,631	140	MAXZO Paint	SUPERSEF	White G1000	-	-	THA 330
1,686	100	SEFCO Chemical (2001)	Y2K SEFCO	White Y100	-	-	THA 342
1,909	100	N/A (2)	SEFCO	White	-	-	THA 334
2,000	88	LENA (Thailand)	6-B	White T-400	-	-	THA 250
2,218	98	Nippon Paint (Thailand)	Junior 99	White 9700	-	-	THA 268
2,495	150	Sahatat Co.,Ltd	XEN	White 100	-	-	THA 343
2,660	120	TKS Chemical (Thailand)	TEMCO	White T400	-	-	THA 328
2,882	145	LENA (Thailand)	Bundai	Sky white D011	-	-	THA 375
3,800	120	Taveepaibul	COMPAC	White 100	-	-	THA 337
4,639	150	KOSMIK Polymer	Super-K	S-222 Purple	-	-	THA 319
4,860	120	TKS Chemical (Thailand)	TEMCO	White T400	-	-	THA 327
6,300	150	IEC Paint	IEC	White A-100	-	-	THA 325
12,100	150	Delta Paint	IBC	Lemon Yellow 434	-	-	THA 265
13,937	120	Sahatat	XEN	Sunspot 177	-	-	THA 299
20,423	150	Nam Dee Watana Chemical	TURBO	Reddish Orange G 2159	-	-	THA 297
21,000	88	LENA (Thailand)	6-B	Reddish Yellow T-317	-	-	THA 251
24,000	150	LENA (Thailand)	BUNDAI	Reddish Orange D 159	-	-	THA 256
24,284	120	Delta Paint	National	Tangerine 401	-	-	THA 280
26,000	130	Sisson Paints (Thailand)	SISTO	Yellow Orange S-104	No Added Lead No Added Mercury	-	THA 290
27,000	90	P.M. Paint	Seal-Jacob	Lemon Yellow S434	-	-	THA 287

Lead Concentration (ppm)	Purchase Price (Thai baht)	Manufacturer	Brand	Color	Lead-Free Label by Manufacturer	Thai Industrial Standards	Sample No.
27,736	120	T.K.S. Chemical (Thailand)	TEMCO	Reddish Yellow T-317	-	-	THA 292
29,000	140	JBP International Paint	Columbia	Marigold 2227	-	-	THA 259
31,000	150*	LENA (Thailand)	Bundai	Reddish yellow D155	-	-	THA 379
32,000	120	Thai TOA Industries	KINZO	Medium Yellow K-757	No Added Lead No Added Mercury	-	THA 270
35,000	140	B.N. Brother	Ben-Tone	Signal red G404	No Added Lead No Added Mercury	-	THA 307
36,000	130	Taveepaibul	TVB	Reddish Yellow T-420	-	-	THA 298
40,000	120	V.Brother Industry	SAMLAC	Yellow SL612	-	-	THA 286
41,000	139	Delta Paint	National	Lemon yellow 301	-	-	THA 316
42,000	100	ThongThai (Paints Industry)	HUNTER	Sulfur yellow 242	-	-	THA 313
46,000	120	Hachem Paint	LOTTO	Sunflower L-1303	-	-	THA 276
47,000	315	DYNO Paint (under license from Rust-Oleum)	Rust-Oleum	Safety Yellow 944	-	-	THA 285
50,000	145*	LENA (Thailand)	Bundai	Sulfur yellow D160	-	-	THA 376
50,000	110	Nakoya Paint (Thailand)	Nakoya	Lemon drop 7752	-	-	THA 315
51,000	120	SEFCO Chemical (2001)	Y2K SEFCO	Sulphur Yellow Y2160	-	-	THA 300
52,000	145	PPM Commercial	VICTOR	Yellow orange P-444	-	-	THA 318
54,000	125	Maneekarn Paint	D.I.Y.	Butter cup 175 (yellow)	-	-	THA 310
55,480	245	DYNO Paint	DYNO Pro	Bright Yellow G*115	-	-	THA 263

Lead Concentration (ppm)	Purchase Price (Thai baht)	Manufacturer	Brand	Color	Lead-Free Label by Manufacturer	Thai Industrial Standards	Sample No.
59,000	120	Thai TOA Industries	DENZO	Yellow D-612	No Added Lead No Added Mercury	-	THA 261
61,000	120	HATO Paint	HATO	Yellow N344	-	-	THA 352
66,000	140	MAXZO Paint	SUPERSEF	Yellow G2103	-	-	THA 317
68,000	120	N/A (2)	SEFCO	Sulphur Yellow S-160	-	-	THA 289
71,000	98	Nippon Paint (Thailand)	Junior 99	Red 9707	-	-	THA 269
72,000	130	TOP Paint Perfect	TOP	Yellow Orange T-1444	-	-	THA 295
79,000	180	JBP International Paint	JBP	Golden Yellow 003	-	-	THA 267
112,000	170	Thai Kansai Paint	FTALIT	Lemon yellow 581	-	-	THA 312

Ecological Alert and Recovery - Thailand (EARTH)

Ecological Alert and Recovery - Thailand (EARTH) is an independent non-governmental organization striving for social and environmental sustainability and justice in Thai society. EARTH serves as a watchdog monitoring the Thai government's industrialization policy, industrial pollution and unsustainable consumption patterns. We promote climate justice, good governance and accountability of governmental and international agencies. EARTH focuses on the impacts of hazardous substances on ecosystems, local communities and workers' health.

Environmental and social challenges taken up by EARTH include:

- public access to information about toxics release;
- community empowerment in environmental and health monitoring;
- education about pollutants' impact on human health, i.e. child development and reproductive health;
- sound hazardous waste management and disposal;
- monitoring of toxic chemicals;
- climate justice.

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