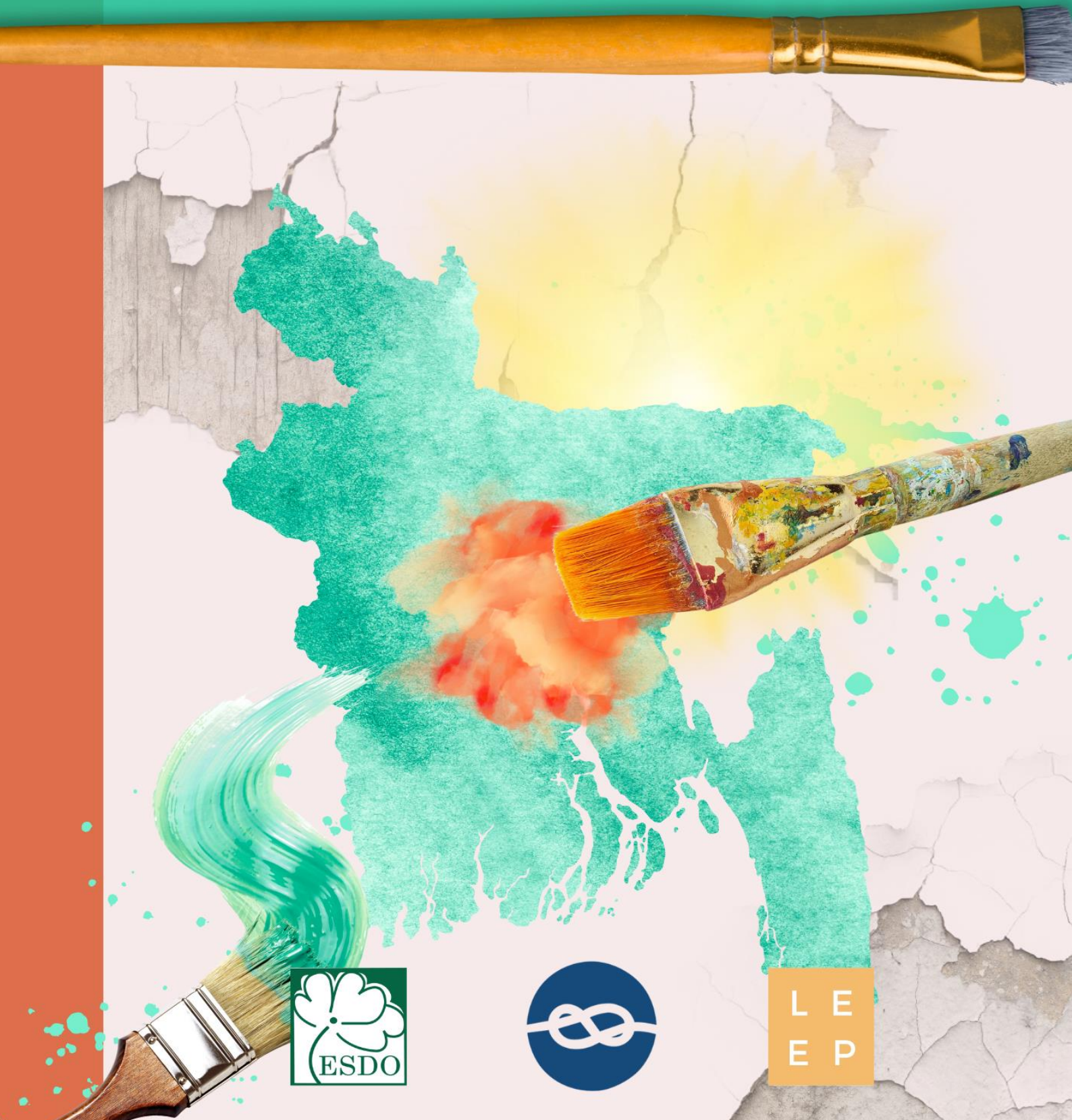


Colors of Concern: Assessing Lead in Paints and Progress Toward a Lead-Safe Bangladesh



Colors of Concern: Assessing Lead in Paints and Progress Towards a Lead-Free Bangladesh



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About ESDO

Environment and Social Development Organization- ESDO is an action research-oriented non-profit and non-government organization based in Bangladesh. It is an environmental action research group dedicated to a toxic-free, zero-waste planet. This entails fighting pollution and building regenerative solutions in cities through local campaigns, shifting policy and finance, research and communication initiatives, and movement building. ESDO is working relentlessly to ensure biological diversity since its formation in 1990. It is the pioneer organization that initiated the anti-polythene campaign in 1990, which later resulted in a complete ban on polythene shopping bags throughout Bangladesh in 2002.



About Instiglio

Instiglio is a global nonprofit organization dedicated to improving the effectiveness of social programs through results-based financing and performance management. Established in 2012, the organization works with governments, donors, and implementing partners to design and implement innovative financing mechanisms that link funding to measurable outcomes. Instiglio focuses on strengthening public service delivery in sectors such as health, education, and social protection, while promoting accountability, efficiency, and evidence-based decision-making to maximize social impact, particularly for vulnerable populations.



About LEEP

LEEP is an international nonprofit initiative dedicated to eliminating lead exposure globally, with a primary focus on lead paint. The project works to protect public health—especially children—by supporting governments in developing and enforcing lead paint regulations, generating scientific evidence, and accelerating policy action. LEEP collaborates with research institutions, NGOs, and policymakers to identify high-risk sources of exposure, promote cost-effective interventions, and scale solutions that reduce lead poisoning and its long-term health and economic impacts.

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Contents

Executive Summary	6
Key Findings from the Study:.....	7
1. Introduction.....	9
1.1. Overview of the Previous Report.....	9
1.2. Importance of the Current Study.....	10
1.3. Objective of the Study	10
2. Lead in Paints.....	11
2.1. Background	11
2.2. Sources of Lead in Paints.....	12
2.2.1. Intentional Sources.....	12
2.2.2. Unintentional Sources	13
2.2.3. Lead-based Driers and Anti-corrosive Additives	13
2.2.4. Industrial and Traffic Paints	14
2.2.5. Imported Paints and Locally Manufactured Paints	15
2.2.6. Historical Lead Paints in Buildings and Infrastructure.....	15
2.2.7. Trade in Lead Chromate Pigments and Global Supply Chains.....	16
2.3. Exposure Pathways of Lead from Paints	16
2.3.1. Ingestion of Paint Chips and Household Dust	17
2.3.2. Inhalation of Airborne Paint Particles and Aerosols	17
2.3.3. Soil Contamination from Lead-Based Paints.....	18
2.3.4. Indirect Food and Water Contamination	19
2.3.5. Prenatal (Transplacental) Exposure and Maternal Transfer.....	19
2.3.6. Occupational and Take-Home Exposure.....	20
2.3.7. Environmental Redistribution from Specialty Uses	21
2.4. Impacts of Lead in Paints.....	22
2.4.1. Health Impacts	22
2.4.2. Environmental Impacts	25
3. Overview of Bangladesh Paint Industry:	28
4. Methodology:.....	30
3.1. Desk Review	31
4.2. Key Informant Interviews (KII).....	31

4.3. Stakeholder Workshops.....	32
4.4. Market Survey and Sampling Strategy	32
4.5. Laboratory Analysis	35
5. Regulatory Review of Lead in Paints:	38
5.1. Global and Regional Context:.....	38
5.1.1. SAICM GEF Project - Lead in Paint component.....	40
5.1.2. The Model Law Guidance for Lead Paint.....	41
5.1.3. The Basel Convention and Lead Paint Waste	41
5.1.4. The Rotterdam Convention and Lead-Based Paints	42
5.1.5. Lead Paint and the Sustainable Development Goals (SDGs)	42
5.2. Bangladesh: Current Situation	43
5.2.1. Existing Paint Regulations	43
5.2.2. Planning Phase: Standards for Industrial Paints	44
5.2.3 Major Regulatory and Institutional Bodies	44
5.2.4 Related Legal Instruments and Policies	45
5.2.5 Paint and Consumer Products	45
5.2.6 Enforcement and Laboratory Capacity	46
5.3. National and Global Regulation Comparison	46
5.3.1. Global Regulation Benchmark.....	47
5.3.2. Comparative Matrix	48
5.3.3. Regulatory Gap Analysis in Relation to Global Practices	49
1. Limited Scope of Existing Standards	49
2. Weak Enforcement and Compliance Mechanisms	49
3. Absence of Mandatory Certification and Pre-Market Testing.....	49
5. Unregulated Import and Use of Lead-Based Pigments	50
6. Inadequate Management of Lead Paint Waste	50
7. Fragmented Institutional Coordination.....	50
8. Gaps in Public Procurement and Occupational Regulations	50
6. Results and Discussion	51
6.1. Findings from Interviews and Consultations	51
1. Regulatory and Governance Gaps	51
2. Economic and Structural Barriers	51

3. Industrial Practices and Occupational Safety	51
4. Infrastructure Deficiencies.....	52
5. Awareness and Stakeholder Understanding	52
6. Environmental and Health Implications	52
6.2. Findings from Market Survey	52
6.3. Findings from Laboratory Analysis:	56
6.3.1. Compliance with Lead Standard (≤ 90 ppm Limit)	56
6.3.2. Top 10 Samples with the Highest Lead Concentrations	57
6.3.3. Distribution of Paint Samples by Lead Concentration Range	57
6.3.4. Color-Wise Compliance Analysis	60
6.3.5. Paint Type–Wise Compliance Analysis	61
6.3.6. Paint Use–Wise Compliance Analysis	61
6.3.7. Country of Origin–Wise Compliance Analysis	62
6.4. Comparative Analysis with Previous Study.....	Error! Bookmark not defined.
6.4.1. Combined Paint Sample Analysis: 2022 vs. 2025	Error! Bookmark not defined.
6.4.2. Comparison of Lead Content Labeling Claims: 2022 vs. 2025.....	Error! Bookmark not defined.
7. Recommendations.....	62
Overarching Goal:.....	63
The Way Forward: A Phased Approach	64
8. Conclusion	65

Executive Summary

Lead exposure remains one of the most pervasive and preventable environmental health hazards globally. Classified by the World Health Organization (WHO) as a **Group 1 toxic metal**, lead affects nearly every system in the human body. It is particularly harmful to **young children**, damaging the **developing brain and nervous system**, leading to **irreversible learning disabilities, reduced IQ, behavioral disorders, and developmental delays**. There is **no known safe level of lead exposure**. Among multiple environmental sources, **lead-based paints** are recognized as one of the **most significant contributors** to household and community lead contamination. When used on walls, furniture, or toys, leaded paints deteriorate over time, producing dust and flakes that contaminate indoor air and soil, posing lifelong exposure risks to children.

In Bangladesh, the problem has been longstanding. Prior to 2018, the country had **no enforceable legal limit** for lead in decorative paints, resulting in widespread circulation of leaded products. Following extensive advocacy, the **Bangladesh Standards and Testing Institution (BSTI)** introduced the **90ppm total lead limit** (aligned with WHO/UNEP Model Law) through **S.R.O. 221-Law/2018**, setting standards for decorative paints such as enamel, emulsion, and distemper. However, industrial and specialized paints remain **unregulated**, and enforcement of existing rules is limited.

This 2025 study by the **Environment and Social Development Organization (ESDO)** in collaboration with **Lead Exposure Elimination Project** and **Instiglio**, supported by UNICEF, represents Bangladesh's **most comprehensive assessment** of lead in paints to date. It combines **market surveys, key informant interviews, and laboratory testing** of **161 paint samples** collected from major paint markets across **Dhaka and Chattogram**, covering both **locally manufactured and imported brands**. Samples were analyzed using **Inductively Coupled Plasma–Optical Emission Spectroscopy (ICP-OES)** following **NIOSH Method 7303**, with a **reporting limit of 49 ppm (0.0049%)**, ensuring precise detection of trace concentrations. The goal was to evaluate the **degree of compliance with the 90ppm standard**, identify **patterns of contamination**, and assess **labeling, awareness, and market practices**.

The findings reveal that while multinational manufacturers **representing 80-85% of the market** have largely transitioned to lead-free production, while **15-20% of the market, mostly consisting of SMEs**, continue to use lead chromate and molybdate pigments - especially in yellow and red shades. Lead levels in one sample (**Kangaroo**) reached **190,000 ppm**, over **2,000 times higher than the permissible limit**, indicating the continued use of raw lead compounds in local manufacturing. Overall, **42% of all paints tested were non-compliant**, confirming that **lead paint remains widely available** in the Bangladeshi market despite the existence of national regulations.

The study also found **gaps in labeling and consumer awareness**. Only **21.6%** of paints carried “lead-free,” “eco-friendly”, or equivalent markings, and more than half of the shop owners surveyed were unaware of BSTI's lead standard. Despite having a lead-free logo, the paint of four companies (**Magic, Ramy, Rauza, and Hyder**) contained lead. All of the above findings underscore the urgent need for mandatory labeling, enhanced surveillance, customs control, and the **inclusion of industrial paints under regulation**, to protect consumers and support Bangladesh's commitment to a **Lead-Free Future** under SDG 3.9 and 12.4.

To sustain Bangladesh's progress toward a lead-free future, stronger monitoring and enforcement mechanisms are essential, particularly targeting small and medium enterprises (SMEs) that remain largely outside formal oversight. Enhanced customs control and random market inspections are also necessary to prevent the entry and sale of imported high-lead paints, especially low-cost spray and enamel products that dominate informal markets.

Additionally, Bangladesh should expand regulation to include industrial paints—such as epoxy, enamel glossy, primers, and powder coatings—as these are often used in both indoor and outdoor applications, creating unintended exposure risks. Public awareness campaigns, led jointly by BSTI, the Department of Environment, and industry associations, should reinforce consumer demand for certified lead-free paints, completing the country's pathway toward a safe and sustainable paint industry.

KEY FINDINGS FROM THE STUDY:

- **42.2% of all samples (68 out of 161)** exceeded the BSTI standard of 90 ppm total lead, **26.2%** contained more than 1,000 ppm lead, and **3.1%** exceeded 50,000 ppm. While **57.8% (93 out of 161)** fell within the safe range (<90 ppm).
- Most top-tier manufacturers (e.g., **Berger, Asian Paints, Nippon**) maintain the 90ppm limit. At the same time, many samples originated mostly from small, local, or unregistered manufacturers did not meet the 90ppm limit.”
- The laboratory analysis revealed extremely high lead concentrations among several paint samples, with values far exceeding the permissible 90 ppm limit. The **Kangaroo** brand (190,000 ppm) recorded the highest concentration, followed by **Euro** (170,000 ppm). Notably, the Kangaroo sample was from an **imported brand**, not manufactured in Bangladesh. Other highly contaminated samples included **Nahar** (81,000 ppm), **New Tua** (74,000 ppm), **Top Seal** (54,000 ppm), **Modina Better Rubilack** (19,000 ppm), **Meghna Plus** (18,000 ppm), **Ramy** (18,000 ppm), and **Turkey** (16,000 ppm). All of these paints were yellow or golden-yellow oil/solvent-based decorative products.
- **All samples exceeding 10,000 ppm lead** came from imported, small-scale or informal producers; most of them did not provide safety labeling, manufacturer address, or certification marks, highlighting a severe regulatory gap in the informal sector.
- Spray paints exhibited **100% non-compliance**, with the highest lead concentration of **54,000 ppm** in one paint. Though these products are primarily intended for industrial or automotive use, given their high lead content and increasing use in non-industrial settings, it is crucial to introduce specific regulations for spray paints.
- **Yellow paints showed the highest contamination**, with 62% of yellow samples exceeding 90 ppm and the highest lead content reaching 190,000 ppm, confirming the continued use of lead chromate pigments for bright coloration. **Red paints (29% non-compliant)** and **white paints (36% non-compliant)** also contained elevated levels of lead, likely due to contamination from driers or pigment blending.
- **Only 21.6% of paints (35 out of 161)** carried any “Lead-Free” or “Eco-Friendly” labeling, of which 4 paints contained lead despite having a lead-free logo.

- 86.5% of retailers confirmed that industrial paints are sold as decorative paints, and according to the sellers, although some products are marketed as industrial paints, they are often used for decorative purposes. Many customers apply a **base coat of industrial paint for durability and brightness**, then cover it with decorative paint for the final finish.
- Both **domestically produced and imported paints** continue to show notable levels of non-compliance with the 90 ppm standard. Among paints tested, **Bangladeshi-made samples showed 38% non-compliance**, imports from **China showed 50% non-compliance**, while **unlabeled imports had the highest non-compliance at 69%**, indicating that regulatory challenges persist across the market regardless of origin.
- **Retail survey revealed limited awareness** — only about 30% of sellers knew about the 90ppm standard, over 50% had “no idea” of compliance status, and most smaller outlets mixed paints manually and sold industrial paints for decorative use.
- Lead levels were found to be **much higher in brightly colored paints**, particularly **yellow and red shades**, compared to lighter tones. This pattern aligns with the continued use of **lead-based pigments** (such as lead chromate) in producing these brighter colors.
- National regulations currently apply **only to decorative paints**, while **industrial, automotive, marine, and powder coatings remain unregulated**. This creates a major policy gap because these industrial paints are widely available in retail markets and are often purchased by consumers for home use, due to their durability and bright finish. As a result, **high-lead industrial paints can easily enter household environments**, increasing exposure risk despite existing regulations.
- **Overall market pattern demonstrates a two-tier system:** regulated multinational and some national producers (80-85% of the market share) adhering to global standards on one side, and a vast, unregulated informal market (10-15% of the market share) supplying low-cost, high-lead paints on the other, sustaining long-term exposure risk.

1. Introduction

Lead is a naturally occurring heavy metal that has been widely used in industrial, household, and consumer products, including paints, batteries, and ceramics. Despite its usefulness, lead is highly toxic and poses serious health hazards. Even at very low levels, lead exposure can damage the brain and nervous system, reduce IQ, impair learning and behaviour, and cause anemia and developmental delays in children. There is no safe level of lead exposure.

Among all potential exposure sources, **lead-based paint** is one of the most preventable yet persistent hazards, especially in low- and middle-income countries. When paint containing lead deteriorates or is disturbed, it produces dust and flakes that contaminate air, soil, and household environments, placing children at high risk of chronic exposure. Recognizing this global concern, the World Health Organization (WHO) and United Nations Environment Programme (UNEP) have promoted the phase-out of lead-containing paints under the Global Alliance to Eliminate Lead Paint (GAELP).

In **Bangladesh**, a series of studies by the **Environment and Social Development Organization (ESDO)** have documented high lead concentrations in decorative and industrial paints. In response, the Bangladesh Standards and Testing Institution (BSTI) adopted in 2018 a mandatory standard (SRO) limiting total lead in decorative (household) paints to **90 parts per million (ppm)**.

Globally, Bangladesh is among the countries with some of the highest childhood lead burdens. A UNICEF / Pure Earth report called *The Toxic Truth* estimated that about **35.5 million children** in Bangladesh have blood lead levels at or above **5 µg/dL**, making Bangladesh the fourth most seriously hit country in terms of the number of children affected ¹.

1.1. Overview of the Previous Report

The 2022 ESDO study, titled “*Lead in Paints: A Significant Pathway of Lead Exposure in Bangladesh*”, provides the most recent comprehensive assessment of lead concentrations in both decorative and industrial paints in major markets (Dhaka, Chattogram, Sylhet, Bogura). Key findings include:

- Total of **63 paint samples** from **39 national and multinational brands** were collected, with 68% decorative paints and 32% industrial paints ²
- Approximately **15.4% of decorative paint samples** exceeded the 90 ppm lead limit.
- Among industrial paints, **~50%** had extremely high lead content, ranging from 5,000 to 100,000 ppm.

¹ https://www.unicef.org/bangladesh/en/press-releases/third-worlds-children-poisoned-lead-bangladesh-fourth-most-seriously-hit-terms?utm_source=chatgpt.com

² https://www.tbsnews.net/bangladesh/half-industrial-colours-contain-excessive-lead-esdo-570846?utm_source=chatgpt.com

- The highest recorded lead concentration was **97,000 ppm** in an industrial paint, including one labelled “lead-free”.
- The study also showed that many paint cans bear “lead-free” or “lead-safe” labels while still containing lead above permissible limits.

The previous report called for stronger regulatory enforcement, expansion of standards to cover industrial paints, improved labeling, and routine surveillance.

1.2. Importance of the Current Study

- To evaluate whether the **90 ppm SRO for decorative paints** is being effectively enforced across the entire market, including small/local manufacturers.
- To measure current levels of lead in both decorative and industrial paints, thereby quantifying remaining exposure risk.
- To compare new data with previous studies (especially the 2022 ESDO report) to assess progress or regression.
- To detect mislabelling or misleading “lead-free” claims, ensuring consumer protection and market transparency.
- To provide robust evidence for policy makers and regulators to consider expanding mandatory lead limits to industrial paints.
- To contribute toward protecting children and vulnerable groups from lead exposure, aligning with Bangladesh’s commitments under GAELP and international health standards.

1.3. Objective of the Study

The primary objective of this year’s study is to **assess current compliance with the 90 ppm lead standard in decorative paints in Bangladesh**, especially how well the SRO is being implemented, and to **compare these findings with the results of the 2022 ESDO study**³.

Specific objectives:

1. Determine the proportion of decorative paints in the market exceeding the 90 ppm lead limit.
2. Assess labelling practices, including whether products labelled “lead-free” or “lead-safe” are truthful.
3. Measure lead concentrations in industrial paints to explore whether regulatory extension is necessary.
4. Generate policy recommendations for improved enforcement, regulation, and surveillance to move toward a fully lead-safe paint market.

³ <https://esdo.org/wp-content/uploads/2023/03/Lead-in-Paint-Paper>

2. Lead in Paints

2.1. Background

Lead (Pb) is a highly toxic heavy metal that has been extensively used in various industrial and consumer products due to its desirable physical and chemical properties, such as durability, corrosion resistance, and pigment quality. However, its persistence and non-biodegradable nature have made lead a major global environmental and public health concern⁴. Once released into the environment, lead remains in soil, air, and water for decades, continually re-entering the food chain and posing chronic health risks to humans, especially children⁵.

Globally, around 800 million children, approximately one in three, have blood lead levels (BLLs) exceeding 5 µg/dL, with the highest burden recorded in South Asia. In Bangladesh, lead exposure remains an acute environmental health challenge. Studies show that Bangladeshi children have among the highest blood lead levels in the world, averaging around 8 µg/dL⁶. Estimates indicate that more than 35 million Bangladeshi children have blood lead levels above 5 µg/dL, a figure far exceeding international safety benchmarks⁷. Lead exposure in Bangladesh originates from diverse sources, including used lead-acid battery recycling, lead-based paints, contaminated spices and foodstuffs, informal metal smelting, ceramics, and lead-contaminated cookware⁸.

Lead in paints, in particular, is one of the most significant yet under-recognized sources of exposure. Paints containing lead-based pigments and additives are used in homes, schools, furniture, and toys. Over time, painted surfaces deteriorate, generating lead-laden dust and flakes that are easily ingested or inhaled, especially by children. The U.S. Environmental Protection Agency⁹ and World Health Organization¹⁰ emphasize that even very low levels of lead in children's blood can impair cognitive function, reduce IQ, and cause behavioral and developmental problems. No safe threshold for lead exposure has been identified, as even minute amounts are associated with adverse health outcomes¹¹.

Bangladesh's environmental and health burden from lead is immense. The Institute for Health Metrics and Evaluation¹² estimated that the country ranks fourth globally for deaths related to lead exposure. Lead poisoning has been associated with long-term neurological, cardiovascular, and renal impairments in adults, while chronic exposure among children leads to irreversible brain damage and reduced academic performance¹³. The cumulative economic

⁴ <https://www.unep.org/resources/report/final-review-scientific-information-lead>

⁵ <https://www.unicef.org/media/73246/file/The-toxic-truth-children%E2%80%99s-exposure-to-lead-pollution-2020.pdf>

⁶ <https://www.thelancet.com/action/showFullText?pii=S2542519620302783>

⁷ <https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health>

⁸ <https://pubs.acs.org/doi/10.1021/acs.est.9b00744>

⁹ <https://www.who.int/data/gho/data/themes/topics/indicator-groups/legally-binding-controls-on-lead-paint>

¹⁰ <https://www.who.int/publications/i/item/9241546204>

¹¹ <https://www.healthdata.org/gbd-tool-access-changes>

¹² <https://pubmed.ncbi.nlm.nih.gov/23669514/>

¹³ <https://www.govinfo.gov/content/pkg/GOVPUB-C13-2af3d0210c05c7818ca2d7d2304df223/pdf/GOVPUB-C13-2af3d0210c05c7818ca2d7d2304df223.pdf>

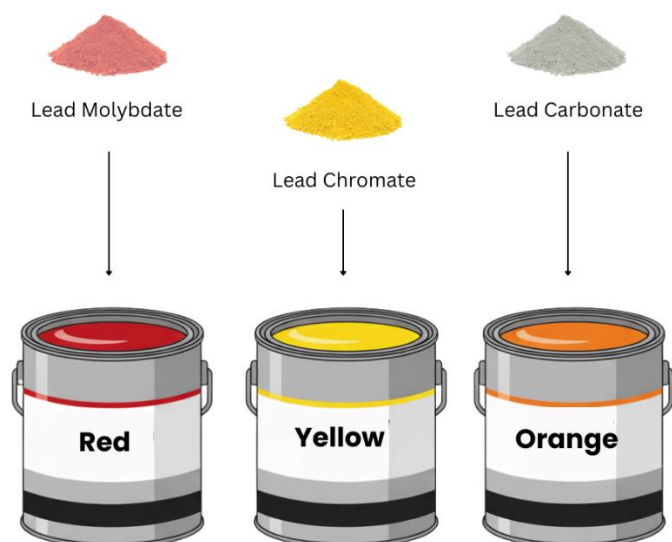
losses attributed to lead exposure, through decreased productivity, medical costs, and IQ loss, are substantial, constraining national development and sustainable growth prospects.

2.2. Sources of Lead in Paints

The presence of lead in paints can be attributed to various sources, as outlined in the subsequent sections:

2.2.1. Intentional Sources

The most widely documented intentional sources of lead in paints are lead-based pigments, particularly those used to achieve bright yellow, orange, and red shades. Among these, lead chromates (PbCrO_4 and related compounds) and lead molybdates (PbMoO_4) are most common, while other compounds such as basic lead carbonate ($2\text{PbCO}_3 \cdot \text{Pb(OH)}_2$) and lead oxide (PbO) have also been used to produce



white and red tones. These pigments are valued in the paint industry for their ability to enhance colour intensity, opacity, and durability. Both regulatory assessments and peer-reviewed literature consistently highlight lead chromates and lead molybdates as the principal intentional lead-containing pigments still encountered in decorative and industrial paints¹⁴. Studies compiled by the International Pollutants Elimination Network (IPEN) and other research groups provide evidence that these pigments remain prevalent in the formulation of lead paints worldwide, where regulatory enforcement may be limited¹⁵.

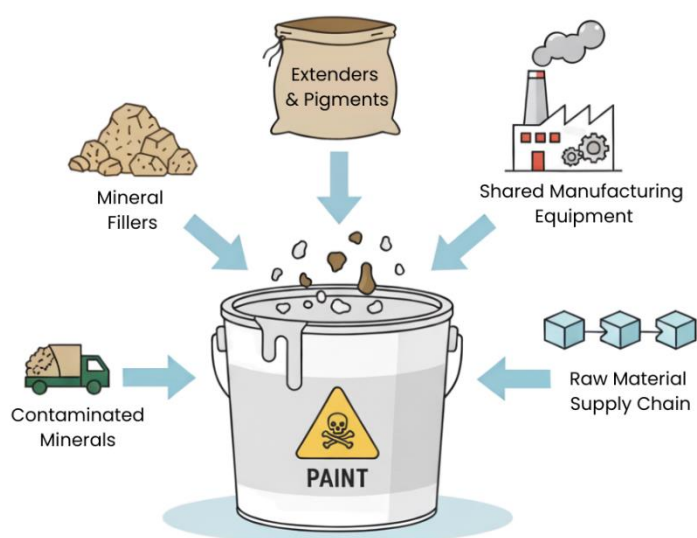
¹⁴ <https://ipen.org/documents/global-lead-paint-elimination-report-2020>

¹⁵ <https://www.sciencedirect.com/science/article/abs/pii/S0300944022005446>

2.2.2. Unintentional Sources

Lead may also enter paint formulations

unintentionally through the use of contaminated mineral fillers, extenders, and pigments, or via cross-contamination in shared manufacturing equipment and raw material supply chains. According to international regulatory guidance and technical reviews, paints produced with carefully sourced, uncontaminated raw materials and without the deliberate addition of lead

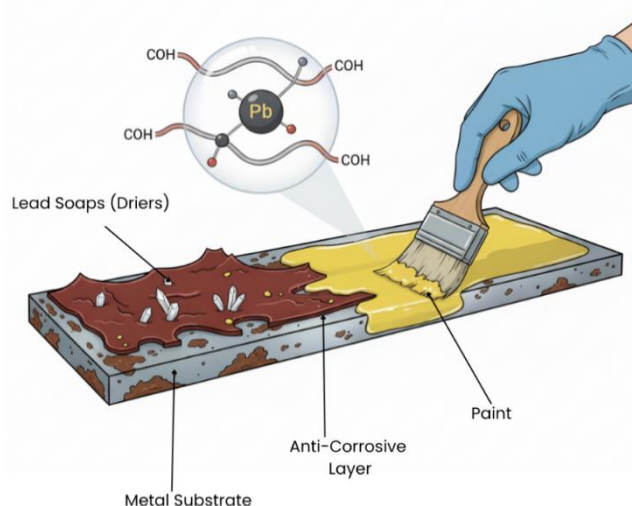


UNINTENTIONAL SOURCES OF LEAD

typically contain very low lead concentrations. In contrast, poor quality control, inadequate sourcing practices, or the use of contaminated inputs can result in elevated lead levels even in products not intended to contain lead¹⁶.

2.2.3. Lead-based Driers and Anti-corrosive Additives

Lead soaps (i.e., lead carboxylates) and other lead salts have long been incorporated into paint formulations, primarily serving as driers in solvent-based coatings and as anti-corrosive additives in metal coatings¹⁷. These compounds facilitate oxidation and curing of the film and improve the protective properties of metal surfaces. Though their use has diminished substantially in many jurisdictions, some formulations still permit lead-based compounds, and legacy or old paint stocks can still



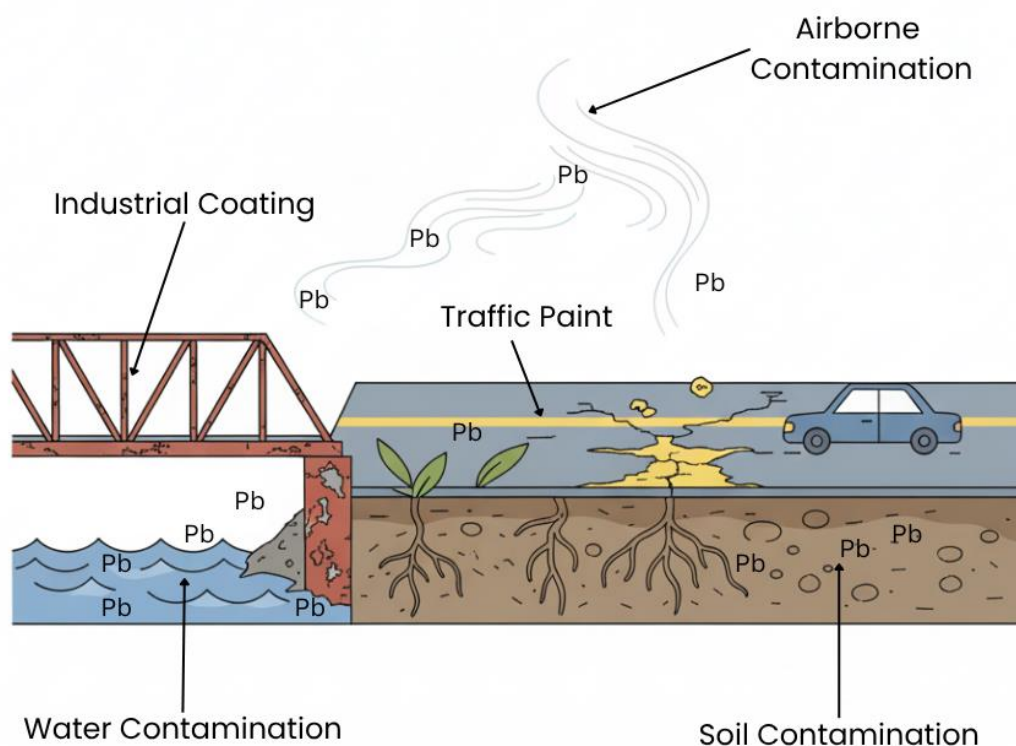
¹⁶ <https://www.unep.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/global-alliance-eliminate-lead-paint/faq>

¹⁷ <https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2015.00144/full>

contain them¹⁸. Regulatory reviews and chemical inventories document that lead carboxylates and related salts continue to appear in historical or specialized coating systems¹⁹. For instance, in the Australian regulatory evaluation, lead soaps have been explicitly discussed as drying agents in paints and varnishes, though restrictions now limit permissible lead content²⁰. The WHO's Model Law and Guidance for Regulating Lead Paint also notes that lead-based driers can contribute several thousand ppm of lead to total paint content, particularly in red and yellow formulations, underscoring their relevance to residual lead load even when pigments are replaced²¹.

2.2.4. Industrial and Traffic Paints

Traffic paints and industrial coatings, such as those used for road markings, marine applications, and anti-corrosion protection of steel structures, have historically incorporated lead chromate pigments. These formulations are known to contain very high concentrations of lead, often exceeding regulatory limits. Evidence from field investigations and atmospheric monitoring studies demonstrates that traffic paints containing lead chromate act as localized sources of both environmental lead and hexavalent chromium (Cr(VI)), contributing to soil, dust, and air contamination in areas of application and wear²².



¹⁸ https://www.industrialchemicals.gov.au/sites/default/files/1_2%20Lead%28%2B%29%20salts%20of%20long-chain%20carboxylic%20acids_Environment%20tier%20II%20assessment.pdfs

¹⁹ <https://www.industrialchemicals.gov.au/sites/default/files/2022-01/EVA00024%20-%20Evaluation%20statement%20-%202014%20January%202022%20%5B1842%20KB%5D.pdf>

²⁰ <https://www.nature.com/articles/srep36088>

²¹ <https://ipen.org/documents/global-lead-paint-elimination-report-2020>

²² <https://ipen.org/documents/lead-solvent-based-paints-home-use-bangladesh>

2.2.5. Imported Paints and Locally Manufactured Paints

In countries where regulatory standards for lead in paints are either absent or weakly enforced, both imported brands and locally manufactured solvent-based enamel paints have been documented to contain elevated lead



concentrations. Surveys conducted by national and international NGOs across multiple low- and middle-income countries, including Bangladesh, have consistently reported paints with lead levels exceeding the internationally recognized benchmark of 90 ppm, with some samples registering above 10,000 ppm²³. Bangladesh-specific evidence further supports this pattern. Testing undertaken by the International Pollutants Elimination Network (IPEN) on consumer solvent-based paints available in Bangladesh revealed that a substantial proportion of samples contained lead concentrations well above the 90 ppm limit, with several paints exhibiting levels in the thousands to tens of thousands ppm. Findings from ESDO, a national non-governmental organization, corroborate the ongoing presence of high-lead paints in the domestic market, underscoring gaps in regulatory standards and enforcement mechanisms²⁴.

2.2.6. Historical Lead Paints in Buildings and Infrastructure

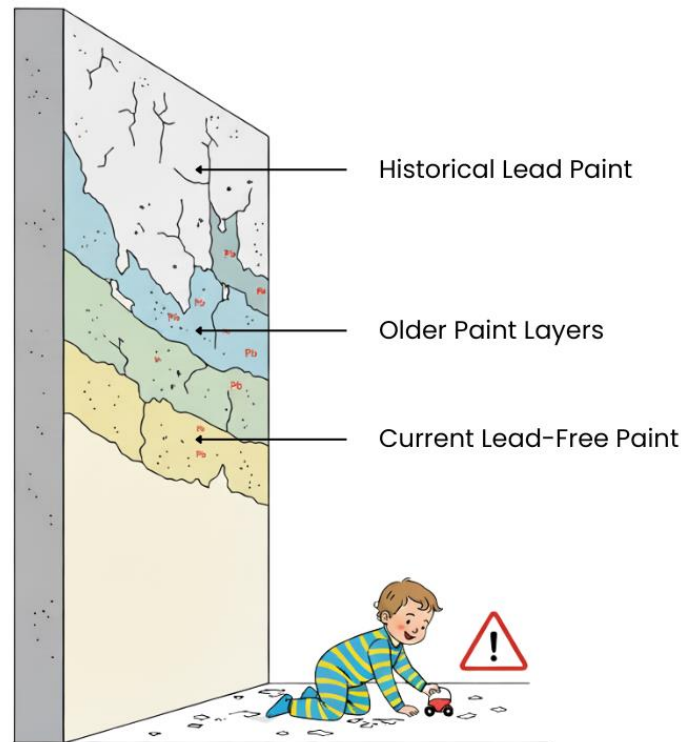
Even in settings where current paint formulations contain minimal or no added lead, existing layers of historical lead-based paints in buildings and infrastructure continue to pose a significant source of lead exposure. This risk is particularly pronounced when such paints deteriorate, peel, or are disturbed during maintenance, renovation, or demolition activities²⁵. Numerous reviews and regulatory assessments of lead paint hazards underscore the persistent legacy of lead-containing coatings in the built environment, which remains a critical consideration for public health and exposure mitigation strategies²⁶.

²³ <https://www.sciencedirect.com/science/article/pii/S0160412018314351>

²⁴ <https://www.epa.gov/lead/learn-about-lead>

²⁵ <https://pmc.ncbi.nlm.nih.gov/articles/PMC4961898/>

²⁶ <https://www.cdc.gov/lead-prevention/about/index.html>



2.2.7. Trade in Lead Chromate Pigments and Global Supply Chains

Evidence from NGO investigations and international trade reviews indicates the continued global production and trade of lead chromate pigments, allowing these lead-containing materials to enter domestic markets through imports and cross-border supply chains. Despite restrictions in many high-income countries, lead chromates remain in use for traffic paints, industrial applications, and specialty coatings in various regions.



2.3. Exposure Pathways of Lead from Paints

Lead-based paints represent one of the most persistent and widespread sources of human lead exposure globally. Once applied, lead-containing paints continue to release lead particles throughout their lifecycle, during application, wear, weathering, or removal. As these painted surfaces deteriorate, lead is released into household dust, soil, and air, creating multiple pathways through which people, particularly children and workers, can be exposed. Even decades after the use of lead paints has been restricted or banned in many countries, legacy coatings on older buildings, infrastructure, and consumer products remain a major environmental and public health concern. There are several well-documented pathways of lead exposure from paints. The most important are:

2.3.1. Ingestion of Paint Chips and Household Dust

For the general population, and especially for young children, the ingestion of lead-contaminated settled dust and paint chips constitutes the primary exposure pathway associated with lead-based paints. Children are particularly vulnerable because of their frequent hand-to-mouth and object-to-mouth behavior, which increases the likelihood of ingesting lead-contaminated particles. Indoor dust contamination commonly arises from deteriorating lead-based paint (e.g., peeling or chipping surfaces), friction surfaces such as windows, doors, and sills, and from renovation, repair, or demolition activities that disturb painted materials. These processes generate fine, ingestible lead-bearing dust that accumulates in homes, schools, and childcare settings. This ingestion pathway is recognized as the dominant route of childhood lead exposure and is strongly associated with adverse neurodevelopmental outcomes, even at very low blood lead concentrations, with no threshold considered safe²⁷.



2.3.2. Inhalation of Airborne Paint Particles and Aerosols

Activities such as sanding, scraping, dry stripping, thermal removal, demolition, and spray application of paints generate respirable lead-bearing aerosols that pose significant inhalation hazards. This exposure pathway is particularly relevant for adult workers, including painters, renovation and demolition crews, and automobile spray-painters. Occupational health monitoring and epidemiological case studies consistently demonstrate elevated airborne lead concentrations and increased blood lead levels

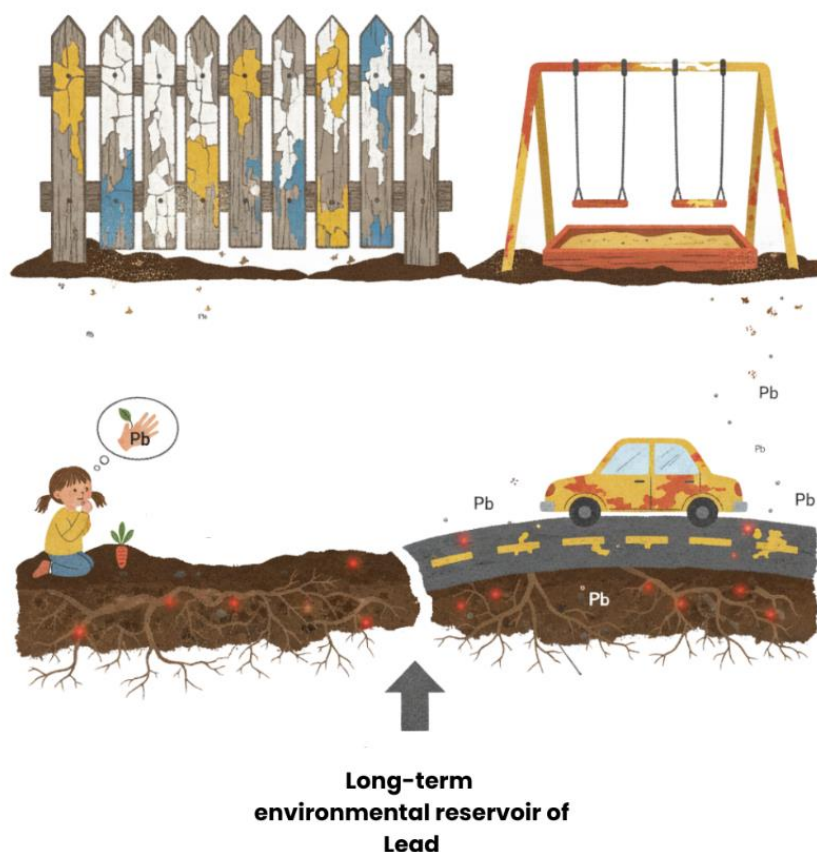


²⁷ <https://pubmed.ncbi.nlm.nih.gov/16369115/>

among workers engaged in spray-painting, metal-coating, and related industrial processes²⁸.

2.3.3. Soil Contamination from Lead-Based Paints

Exterior flaking paint and coatings applied to outdoor structures, fences, playground equipment, and similar surfaces contribute to the deposition of lead particles into adjacent soils. Once contaminated, soil functions as a long-term environmental reservoir of lead, maintaining exposure risks for many years. Children are particularly vulnerable through direct soil ingestion, hand-to-mouth activity, and secondary exposure via homegrown vegetables cultivated in contaminated soils. In addition, traffic and road-marking paints containing lead chromate have been shown to shed pigment particles, which accumulate in roadside soils and further exacerbate localized contamination. These pathways highlight the role of soils as a persistent medium of exposure linked to deteriorating or weathered lead-based paints²⁹.

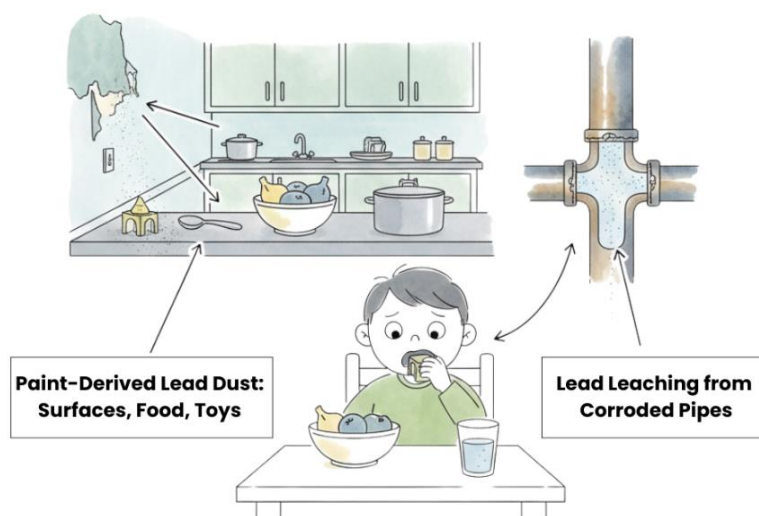


²⁸ <https://www.epa.gov/large-scale-residential-demolition/lead-based-paint-and-demolition>

²⁹ <https://link.springer.com/article/10.1007/s12665-013-2741-0>

2.3.4. Indirect Food and Water Contamination

Lead-contaminated dust generated from deteriorating or disturbed paint can settle on food preparation surfaces, cooking utensils, toys, and food items, thereby contributing to dietary ingestion of lead. In some cases, the presence of lead-based paint on pipes, storage tanks, or other food-contact surfaces may also result in contamination, although this is distinct from the well-



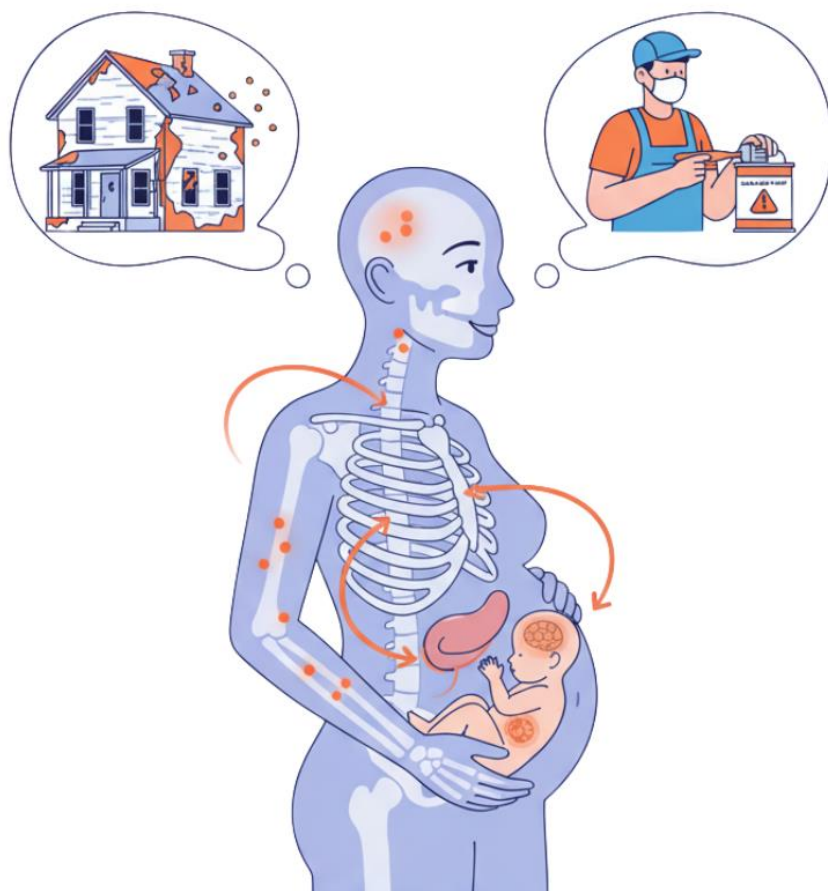
recognized pathway of lead leaching from corroded plumbing systems. The accumulation of paint-derived lead on household surfaces is considered a significant exposure pathway and an important contributor to total lead ingestion in children, amplifying risks associated with other environmental and dietary sources³⁰.

2.3.5. Prenatal (Transplacental) Exposure and Maternal Transfer

Lead accumulated in maternal bone from prior exposures, including historical contact with lead-based paints, can be mobilized during pregnancy and cross the placenta, resulting in fetal exposure. Consequently, a mother's exposure history, encompassing both past and ongoing household or occupational contact with lead-containing paints, has significant implications for in utero lead exposure and subsequent early childhood developmental outcomes³¹.

³⁰ <https://www.cdc.gov/lead-prevention/about/index.html>

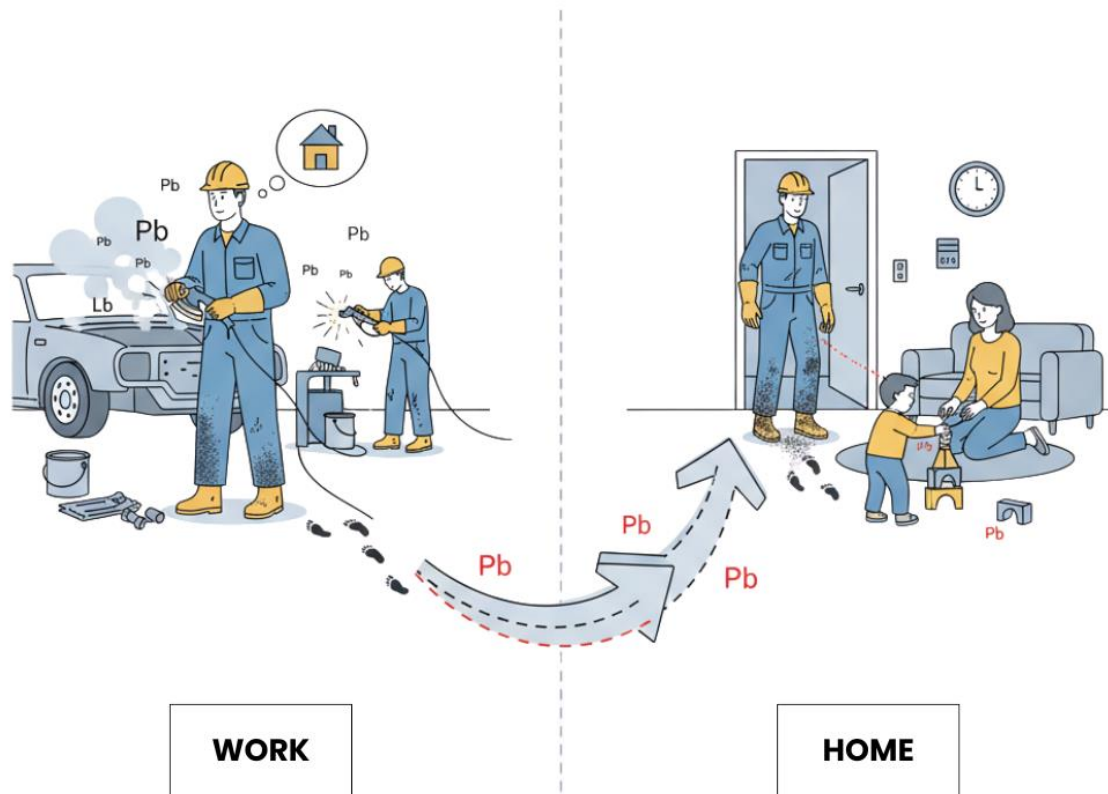
³¹ <https://www.epa.gov/sites/default/files/documents/r96-005.pdf>



2.3.6. Occupational and Take-Home Exposure

Workers involved in painting, construction, recycling, and informal sector activities, including automobile body shops and small-scale workshops, are at elevated risk of lead exposure through inhalation and dermal contact. In the absence of adequate engineering controls, personal protective equipment, and hygiene practices, lead-contaminated clothing, tools, and equipment can be inadvertently transported into homes, resulting in secondary exposure to household members, including children. Field biomonitoring and workplace studies, encompassing both formal and informal occupational settings, consistently document this “take-home” exposure pathway, highlighting its significance as a contributor to overall lead burden in affected communities³².

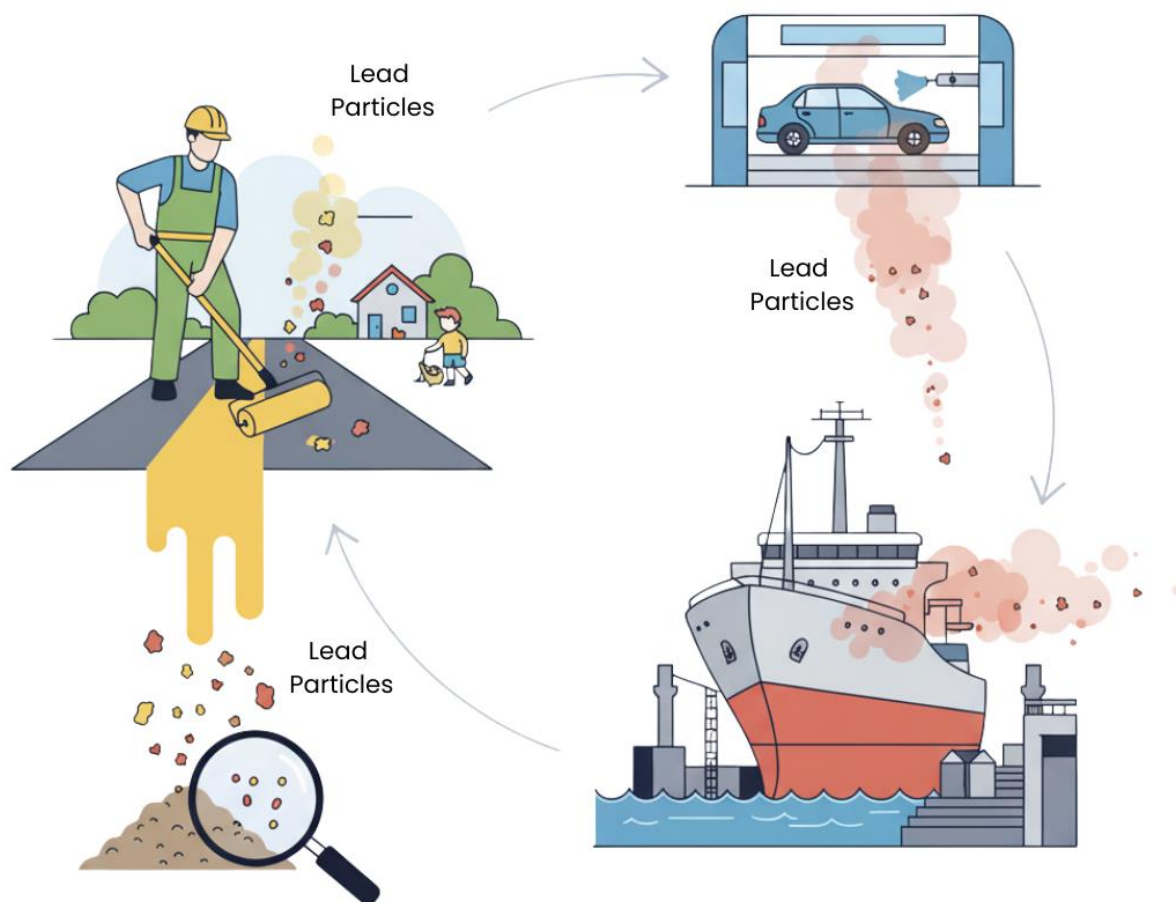
³² <https://www.epa.gov/lead/protect-your-family-sources-lead>



2.3.7. Environmental Redistribution from Specialty Uses

Certain specialty paint applications, including road marking paints, marine and industrial anti-corrosion coatings, and specific automotive paints, can contain high concentrations of lead, primarily in the form of lead chromate and lead oxide. These paints can release lead into the air and surrounding solids during application, maintenance, and weathering, resulting in localized environmental contamination and increased exposure risk for nearby populations. Empirical studies have demonstrated that lead chromate from traffic paints can act as a significant airborne source of environmental lead, contributing to soil and dust contamination in urban and roadside settings³³.

³³ <https://publications.aap.org/pediatrics/article/154/Supplement%202/e2024067808F/199575/Effects-of-Blood-Lead-Levels-Ilt-10-g-dL-in-School>



2.4. Impacts of Lead in Paints

Lead-based paints continue to pose serious and long-term threats to both human health and the environment, despite regulatory efforts and the availability of safer alternatives. Once applied, lead in paint remains stable only temporarily; as the paint ages, weathers, or deteriorates, it releases microscopic lead particles and dust into the surrounding environments. These particles are highly persistent and can be easily inhaled or ingested, leading to chronic exposure among children, adults, and workers. The toxicity of lead arises from its ability to mimic and interfere with essential biological cations such as calcium, iron, and zinc, thereby disrupting a wide range of physiological and biochemical processes within the body³⁴.

2.4.1. Health Impacts

Neurodevelopmental Effects

Children are particularly susceptible to the toxic effects of lead, even at very low blood lead levels (below 5 µg/dL). Such exposures have been consistently associated with impaired cognitive development, including damage to the central nervous system, reductions in

³⁴ <https://www.who.int/data/gho/data/themes/topics/indicator-groups/legally-binding-controls-on-lead-paint>

intelligence quotient (IQ), as well as deficits in attention, memory, and overall academic performance³⁵. Exposure during early life, encompassing prenatal development and infancy, is especially harmful due to the rapid growth and differentiation of the brain. Lead disrupts critical neurodevelopmental processes, including synapse formation, neurotransmitter signaling, and neuronal network connectivity, thereby compromising the establishment of healthy cognitive and behavioral function³⁶. Chronic or repeated exposure in childhood is further linked to behavioral disorders, learning disabilities, and diminished school performance, which can persist into adolescence and adulthood. These effects underscore the long-term neurodevelopmental and societal consequences of early-life lead exposure, even at levels previously considered “low”³⁷.

Hematological Effects

Lead interferes with heme synthesis by inhibiting key enzymes such as delta-aminolevulinic acid dehydratase (ALAD) and ferrochelatase, leading to reduced hemoglobin production and the accumulation of precursor compounds like zinc protoporphyrin³⁸. This disruption results in anemia, characterized by symptoms including fatigue, weakness, and pallor. Chronic exposure to lead can exacerbate these effects, particularly in individuals with existing iron or calcium deficiencies, as lead competes with these essential minerals during absorption and metabolism³⁹. Studies have documented that lead-induced anemia tends to be more severe than that caused by iron deficiency alone, and the presence of both deficiencies can amplify the hematological impacts⁴⁰. Evidence from both occupational health investigations and clinical studies consistently reports these hematological effects in both children and adults, highlighting the systemic nature of lead toxicity and the importance of addressing nutritional deficiencies in populations at risk⁴¹.

Renal Effects

Chronic exposure to lead has been associated with nephropathy, reduced glomerular filtration rate (GFR), and kidney damage in adults. Occupational studies among painters and industrial workers have shown a higher incidence of renal impairment correlated with blood lead levels. For instance, a study by Kuraeiad et al.⁴² found that high blood lead levels (>40 µg/dL) were associated with renal impairment among occupational workers. Similarly, Rastogi [46] discussed how low-level lead exposure resulting in blood lead levels between 10 and 15 µg/dL can lead to deleterious effects like cognitive impairment, behavioral deficits, high blood pressure, and impaired renal function.

³⁵ <https://pmc.ncbi.nlm.nih.gov/articles/PMC2858639/>

³⁶ <https://www.sciencedirect.com/science/article/abs/pii/S0013935119304402>

³⁷ <https://www.sciencedirect.com/science/article/pii/S0041008X21003987>

³⁸ <https://pmc.ncbi.nlm.nih.gov/articles/PMC1242086/>

³⁹ <https://www.sciencedirect.com/science/article/abs/pii/S0946672X23000688>

⁴⁰ <https://pmc.ncbi.nlm.nih.gov/articles/PMC8071292/>

⁴¹ <https://pmc.ncbi.nlm.nih.gov/articles/PMC1242086/>

⁴² <https://pmc.ncbi.nlm.nih.gov/articles/PMC2796746/>

Cardiovascular Effects

Chronic lead exposure has been consistently associated with elevated blood pressure (hypertension) and an increased risk of cardiovascular disease, particularly among adults with prolonged or cumulative exposure. Epidemiological studies indicate that lead accumulates in vascular tissue, contributing to arterial stiffness, endothelial dysfunction, and atherosclerosis, which collectively heighten the risk of heart disease and cardiovascular mortality. For example, studies using bone lead measurements have demonstrated that cumulative lead exposure is strongly correlated with increased systolic and diastolic blood pressure, arterial rigidity, and long-term cardiovascular mortality⁴³. These findings highlight the importance of minimizing lead exposure to protect long-term cardiovascular health.

Reproductive and Prenatal Effects

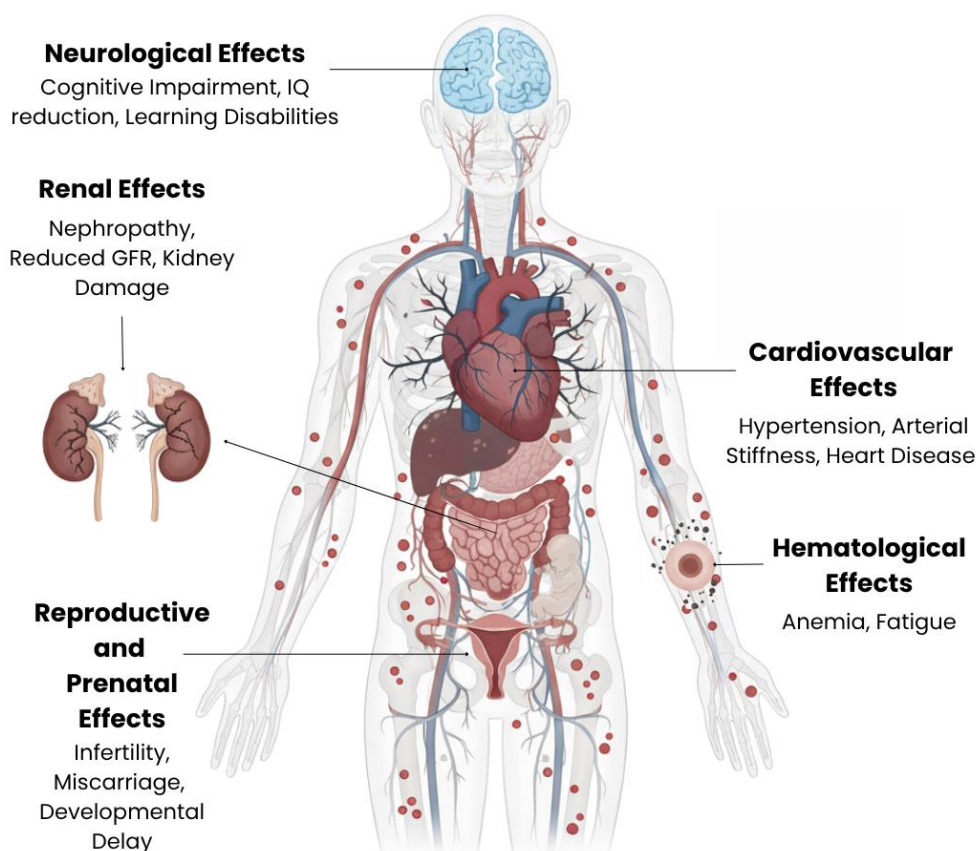
Lead readily crosses the placenta, leading to fetal exposure that can result in miscarriage, preterm birth, low birth weight, and neurodevelopmental delays. Studies have shown that even low maternal blood lead levels can increase the risk of these adverse outcomes. For example, a systematic review by Santana et al.⁴⁴ found that gestational exposure to lead is associated with spontaneous abortions, preterm birth, lower infant birth weight and length, and neurological dysfunctions. In adults, lead exposure can impair fertility in both males and females. In men, elevated blood lead levels have been linked to reduced sperm count, motility, and increased sperm abnormalities. In women, lead exposure can cause menstrual irregularities, reduced fertility potential, and altered hormonal levels. These effects underscore the importance of minimizing lead exposure during reproductive years to protect both maternal and fetal health⁴⁵.

⁴³ <https://www.sciencedirect.com/science/article/abs/pii/S0890623823000151>

⁴⁴ <https://www.cdc.gov/niosh/reproductive-health/prevention/lead-metals.html>

⁴⁵ <https://pubmed.ncbi.nlm.nih.gov/30647514/>

IMPACTS OF LEAD TOXICITY ON HUMAN BODY



2.4.2. Environmental Impacts

Soil Contamination

Deteriorating lead-based paint on exterior surfaces, such as windowsills, doors, and fences, can release lead particles into the surrounding soil, creating persistent environmental reservoirs. This contamination is particularly hazardous to young children, who are more likely to engage in hand-to-mouth behaviors, increasing the risk of lead ingestion. Studies indicate that soil near older homes and urban areas, where lead-based paints were commonly used, often contains elevated levels of lead, posing ongoing exposure risks⁴⁶.

Water Contamination

Lead-laden dust and paint debris can enter water bodies via runoff, particularly during construction or demolition activities. The process of demolishing older housing generates dust that includes lead from interior and exterior lead-based paint. This lead dust eventually falls and settles on surfaces, and can be transported into nearby water bodies through runoff, especially during rainfall or irrigation events. Environmental studies highlight urban runoff as a vector for lead from paints, contributing to indirect human exposure and affecting aquatic

⁴⁶<https://pubmed.ncbi.nlm.nih.gov/31611401/>

life. For instance, a study by Davis et al.⁴⁷ assessed lead runoff from painted structures in an urban setting and found high lead concentrations in many cases⁴⁸.

Airborne Particulate Contamination

Mechanical and thermal removal of lead-based paint, such as through sanding, scraping, or heat application, releases fine particulate matter containing lead into the ambient air. These airborne particles are easily inhaled and can subsequently deposit onto soil, water surfaces, vegetation, and household dust, creating multiple pathways for human and ecological exposure. Children are particularly vulnerable, as inhaled or ingested lead particles can accumulate in the body and cause long-term health effects. Moreover, studies have demonstrated that lead-containing particulates generated during renovation and demolition activities can disperse beyond the immediate site, contributing to neighborhood-scale contamination⁴⁹. This secondary deposition highlights the persistence of lead in the environment and underscores the need for strict dust-control measures during paint removal processes.

Impact on Ecosystems and Biota

Lead is highly persistent in soils and sediments and resists natural degradation, thus acting as a long-term environmental contaminant. In soil systems, lead can disrupt microbial communities, inhibit enzymatic activity, and impair nutrient cycling, effects that reduce soil fertility and compromise plant health⁵⁰. Plants may absorb lead from contaminated soils, allowing the metal to enter the terrestrial food web through vegetation and soil fauna⁵¹. Besides, it affects the biochemical properties of plants and reduces the photosynthesis rate in plants. Wildlife, particularly small mammals and birds, may ingest paint chips or lead-laden particles from soil, leading to neurological, reproductive, and developmental toxicity. In avian species, lead exposure has been linked to reduced clutch size, embryo mortality, growth retardation, and behavioral deficits⁵². Ecotoxicological research further shows that newer lead inputs to soils tend to be more bioavailable and toxically active than aged, weathered lead forms [60]. These findings underscore that soil contamination from lead-based paint can inflict multi-trophic ecological harm and maintain exposure pathways over extended periods.

⁴⁷ <https://pmc.ncbi.nlm.nih.gov/articles/PMC1241046/>

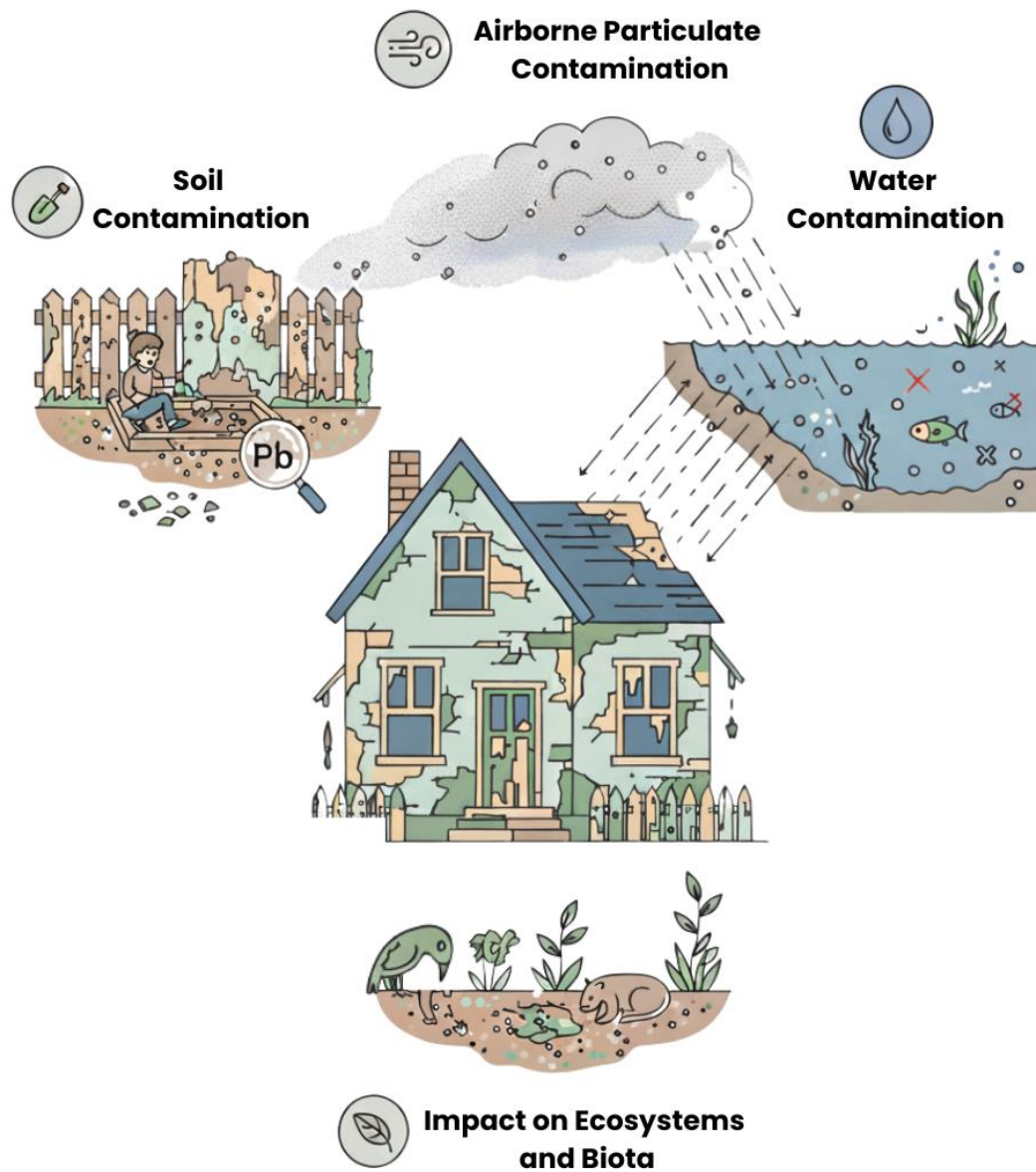
⁴⁸ <https://link.springer.com/article/10.1007/s12665-013-2741-0>

⁴⁹ <https://www.epa.gov/lead/lead-renovation-repair-and-painting-program>

⁵⁰ <https://www.sciencedirect.com/science/article/pii/S266691102200017X>

⁵¹ <https://pubmed.ncbi.nlm.nih.gov/7643427/>

⁵² <https://onlinelibrary.wiley.com/doi/full/10.1002/etc.5051>



3. Overview of Bangladesh Paint Industry

1. Market Structure and Key Players

The paint industry of Bangladesh is one of the most dynamic segments within the country's manufacturing sector. The market is dominated by multinational corporations (MNCs) which hold ~80-85% of the market, with **Berger Paints Bangladesh Limited** holding the largest share, commanding approximately ~54% of the total decorative paint market. **Asian Paints Bangladesh Ltd.** ranks second with around ~18%, followed by Kansai Nerolac and **Nippon Paints** with ~7% and 3%. There are also some larger national manufacturers such as Elite (~6% market share), Multi-Line Industries / **Rainbow Paints** (~4%) and Roxy (~1%)⁵³.

The remaining ~5-10% of the market consists mostly of local small and medium enterprises (SMEs). Overall, multinational brands together control **80–86%** of Bangladesh's formal paint market, while domestic producers operate primarily within lower-cost or regional segments⁵⁴.

2. Market Size and Segmentation

The Bangladeshi paint market has shown consistent growth in line with the country's construction and real estate expansion. Decorative paints dominate the market, followed by industrial coatings, marine coatings, and protective paints. Demand is concentrated mainly in the urban centers—Dhaka, Chittagong, Khulna, and Sylhet—where construction and housing projects are more active.

3. Raw Material Dependence and Import Scenario

Bangladesh's paint industry is **highly import-dependent** for its raw materials. Local manufacturers rely on imported **pigments, resins, solvents, additives, and extenders**. The key raw materials include:

- **Titanium Dioxide (TiO₂):** the primary whitening and opacity pigment, imported mainly from **China** and **India**.
- **Pigments and Colorants:** such as **iron oxides, chromates**, and other specialty pigments mainly from **India and China**.
- **Resins and Binders:** including alkyd, acrylic, and polyurethane-based resins, primarily sourced from **India, Indonesia**, and the **United States**.
- **Solvents and Additives:** such as xylene, toluene, and dispersing agents, imported largely from **India** and other Asian suppliers.

According to trade data (Volza, 2024), **India accounts for approximately 87% of Bangladesh's imports of paint raw materials**, followed by **China, Indonesia**, and the **United States**. TiO₂ shipments alone represent a substantial portion of pigment imports, and nearly all of these materials are sourced from abroad due to the absence of domestic production capacity⁵⁵

4. Lead Chromate Import and Use

⁵³ <https://thefinancialexpress.com.bd/trade/nbr-wants-same-fees-for-bhutans-transit-trial-as-indian-cargo>

⁵⁴ <https://www.coatingsworld.com/the-paint-and-coatings-industry-in-bangladesh/>

⁵⁵ <https://www.volza.com/p/paints/import/import-in-bangladesh/>

Lead chromate (commonly known as **chrome yellow**) is a highly toxic pigment historically used to produce bright yellow paints. Although globally regulated under chemical safety and environmental protection frameworks, its use has not been entirely eliminated in developing countries.

Global trade analyses by **IPEN** and the **Center for Global Development (CGDev)** indicate that shipments of lead chromate pigments continue to flow into several low- and middle-income countries, including Bangladesh. While precise customs-level data are limited, evidence from academic and public health research shows **lead chromate has been present in pigment imports and was historically used in some industrial paints**.

Furthermore, several Bangladeshi studies on **turmeric adulteration** have identified lead chromate contamination, confirming its import and misuse in the country. The lack of public customs data quantifying lead chromate imports (HS 3206 category) poses challenges for regulatory monitoring, emphasizing the need for stronger chemical import surveillance and policy enforcement⁵⁶

5. Imports and Exports of Paints and Coatings

Bangladesh both **imports and exports** paints, although the trade balance is heavily skewed toward imports.

- In the period **October 2023–September 2024**, Bangladesh recorded **around 1,800 import shipments** of finished paints and related products (Volza data). These imports include specialized industrial paints and branded consumer products not manufactured locally.
- Conversely, **paint exports remain negligible**, with the **2023 export value estimated at approximately USD 206,000** (OEC data), mainly comprising small quantities of dyes, varnishes, and coatings shipped to regional markets.

This indicates that Bangladesh's paint industry is primarily **domestic-market-oriented**, with **limited export capacity** and **high dependence on imported raw materials** and semi-finished components⁵⁷.

6. SME Market and Challenges

The **SME segment** of the paint industry comprises about **5-10%** of the total market. These enterprises focus largely on low-cost decorative paints and cater to rural and suburban areas. Their primary challenges include:

- Difficulty accessing high-quality imported raw materials at competitive prices,
- Lack of advanced manufacturing technology and R&D capacity,
- Limited branding and marketing networks compared to multinationals, and
- Weak regulatory enforcement on paint composition, especially regarding lead content.

⁵⁶ <https://www.cgdev.org/sites/default/files/lead-paint-exports-rich-poor-countries.pdf>

⁵⁷ <https://oec.world/en/profile/hs/paints-dyes-and-varnishes>

Encouraging local paint production and supporting SMEs with financial and technical incentives could contribute to developing a more sustainable and competitive domestic paint industry.

7. Policy Implications

Given Bangladesh’s dependence on imported raw materials and the ongoing risk of toxic pigment imports, particularly **lead chromate**, stricter customs monitoring and compliance with international conventions are crucial. Enforcement of the **lead paint standard (maximum 90 ppm lead content)** and implementation of **import restrictions on lead-based pigments** will be essential for protecting public health and achieving a **lead-free paint market**.

8. Summary of Key Statistics

Indicator	Data / Percentage	Source
Berger Paints Market Share	54%	The Daily Star (2025), Financial Express (2023) ⁵⁸
Asian Paints Market Share	16–18%	The Daily Star (2025), Financial Express (2023)
Kansai Nerolac	~7%	Financial Express (2023) ⁵⁹
Elite Paints	~6%	Financial Express (2023)
Nippon Paints	~3%	Financial Express (2023)
Multiline Industries/Rainbow Paints	~4%	Financial Express (2023)
MNCs’ Combined Market Share	80–86%	Emerging Rating (2024)
Dominant Raw Material Import Source	India (≈87%)	Volza 2024
Other Import Sources	China, Indonesia, USA	Volza 2024
Paint Import Shipments (2023–24)	~1,800	Volza 2024
Paint Export Value (2023)	≈ USD 206,000	OEC 2023
Presence of Lead Chromate	Confirmed in pigment imports and turmeric contamination	IPEN, CGDev 2024

4. Methodology:

The methodology adopted for this study was designed to provide a comprehensive and evidence-based understanding of the presence, sources, and implications of lead in paints available in Bangladesh. The approach integrated **quantitative laboratory testing** and **qualitative field assessments** through a mixed-method framework. It included desk-based research, structured market surveys, key informant interviews, laboratory analysis, and multi-stakeholder validation. Each step was systematically planned to ensure reliability, scientific rigor, and policy relevance.

⁵⁸ <https://www.thedailystar.net/business/news/struggling-paint-industry-looks-innovation-revival-3833951>

⁵⁹ <https://thefinancialexpress.com.bd/trade/nbr-wants-same-fees-for-bhutans-transit-trial-as-indian-cargo>

4.1. Desk Review

The desk review served as the foundation of the study, enabling the team to identify existing knowledge, policy gaps, and contextual priorities before initiating fieldwork. It provided the necessary background to design the sampling strategy, questionnaire, and analytical framework.

a. Policy and Legal Frameworks

- Examined the existing national standard — *BSTI's 90 ppm lead limit* for decorative paints — and identified gaps in enforcement, certification, and periodic monitoring.
- Reviewed import control mechanisms, product labelling rules, and the absence of regulations for industrial and automotive paints.

b. Global Standards and Best Practices

- Reviewed international models including UNEP's *Model Law and Guidance for Regulating Lead Paint*, the *Global Alliance to Eliminate Lead Paint (GAELP)* framework, and regional progress reports.
- Case studies from **Thailand, Indonesia, Nepal**, and the **Philippines** were analyzed to extract effective regulatory and market transition mechanisms (e.g., fiscal incentives, labeling schemes, phase-out timelines).

c. Scientific and Environmental Evidence

- Collated data from academic research, government reports, and NGO studies (ESDO, Pure Earth, WHO, UNICEF) on lead exposure pathways, blood lead level studies, and prior market investigations.
- Reviewed literature on raw material sources (pigments, driers, and stabilizers) commonly containing lead compounds

4.2. Key Informant Interviews (KII)

Key Informant Interviews were conducted with a diverse range of stakeholders directly involved in or affected by the production, regulation, and use of lead-based paints. These interviews aimed to gain nuanced, ground-level insights into the challenges and opportunities for improving lead paint standards. A total of **20 in-depth interviews** were conducted. Interviews were semi-structured and guided by thematic prompts, allowing for flexibility.

Stakeholder groups included:

a. Paint Manufacturers and Associations:

- Discussion on current practices, awareness of global standards, and challenges in transitioning to lead-free manufacturing.
- Exploration of the economic and logistical barriers to adopting alternative raw materials.

b. Industry Workers:

- Understanding occupational exposure to lead and the availability of safety measures.
- Workers' awareness of the health risks and suggestions for workplace improvements.

c. Business Owners:

- Perspectives on informal paint manufacturing, challenges in formalization, and their readiness to comply with new regulations.

4.3. Stakeholder Workshops

Workshops were organized to gather insights, foster collaboration, and develop actionable recommendations. These workshops included participants from diverse stakeholder groups, ensuring a holistic view of the issue. Activities within the workshops included:

a. Focused Group Discussions (FGDs):

- Small thematic groups were formed to discuss specific topics such as regulatory gaps, industrial paint standards, and occupational health practices.
- Participants included paint manufacturers, industry associations, workers, representatives, and government officials.

b. Recommendation Development:

- Stakeholders collaboratively developed draft recommendations for improving paint standards, enforcement mechanisms, and stakeholder engagement.
- Discussions highlighted the economic implications of regulatory changes and proposed incentive structures, such as green tax initiatives and subsidies for lead-free production.

c. Feedback Mechanisms:

- Participants provided input on draft findings and policy suggestions, ensuring that proposed solutions were both practical and relevant.

4.4. Market Survey and Sampling Strategy

To determine the prevalence of lead in paints, a **market-based field investigation** was conducted in Dhaka city, the country's primary paint distribution hub. This included **structured market surveys** and **the systematic collection of samples**.

The market survey was designed as part of the study's **mixed-method approach**, combining quantitative information (e.g., product availability, market share, and pricing) with qualitative observations (e.g., awareness, practices, and perceptions). A semi-structured questionnaire—

adapted from international lead paint market assessment tools—was used to guide interviews and ensure comparability across respondents.

a. Geographical Coverage

Sampling was designed to reflect commercial diversity across:

- **Central Dhaka:** Old Dhaka, New Market, Kaptan Bazar, Karwan Bazar and Mohammadpur.
- **North Dhaka:** Gazipur, Uttara, and Tongi.
- **South Dhaka:** Jatrabari, Keraniganj, and Demra.
- **Chittagong:** Southern part of the country, a major hub for paint production and import

These locations were chosen for their concentration of paint wholesalers, retail outlets, and informal shops selling both local and imported paints.

b. Study Design and Scope

The market survey was conducted across major paint markets in **Central, North, and South Dhaka Chittagong**, representing diverse retail environments — from formal outlets and hardware stores to small informal sellers. A total of **50 respondents** participated, including retail shop owners, authorized distributors, small-scale manufacturers, and dealers of both local and imported brands. Each interview, lasting **20–30 minutes**, was carried out **face-to-face** by trained enumerators. Interviews were conducted in **Bangla**, with English technical terms used where appropriate.

c. Questionnaire Structure

The survey used a semi-structured questionnaire combining **open- and close-ended questions**, grouped into six thematic sections aligned with the study’s objectives.

- **Store and Respondent Profile:** Collected background information such as shop name, address, type of business, respondent designation, years in operation, and approximate monthly sales. These data helped define the geographic and business distribution of participants.
- **Brand Availability and Market Composition:** Focused on identifying brand diversity, market share, and sales distribution between oil-based and water-based paints. Respondents listed brands sold, noted popular products, and described customer preferences and industrial paint sales.
- **Market Characteristics and Informal Practices:** Explored the presence of informal paint production, rural versus urban sales channels, and the sourcing of raw materials. Manufacturers were asked about production methods and supply chains, while non-manufacturers shared purchasing sources and any export activity.
- **Product Characteristics and Consumer Preferences:** Assessed product types, color popularity, storage duration, and mixing practices (manual or machine). Questions also

covered the use of paints for children's products or play equipment to understand potential exposure risks.

- **Awareness of Lead Regulations and Compliance:** Examined stakeholder knowledge of BSTI's 90 ppm lead limit, sale of "lead-free" or "eco-friendly" paints, experience with inspections, and perceived challenges to regulation. Respondents also identified motivators for adopting safer production practices.
- **On-site Observations:** Enumerators documented product-specific details such as brand, color, type, price, labeling, and manufacturing date. Photos of paint cans and labels were taken to verify claims and support later laboratory analysis.

d. Sampling Design and Criteria

- A total of **161 paint samples** were collected from **licensed and unlicensed retail shops, hardware outlets, and authorized brand distributors**.
- Selection was guided by:
 - Product popularity (most sold brands and color types)
 - Availability across multiple outlets
 - Color range (Preferably yellow and red, as lead is used mostly in these colors, also white for baseline)
 - Price range and customer segment (premium, mid-tier, economy)
 - Paint category (oil-based, water-based, enamel, emulsion, primer, industrial coating)
- Both **locally manufactured** and **imported** paints were included to capture the full market spectrum.

e. Sample Collection Procedure

- Each sample was collected directly from unopened paint cans or sealed containers to prevent contamination.
- For each, detailed metadata were recorded:
 - Product name, color shade, type (e.g., enamel, primer)
 - Brand/manufacturer
 - Batch number and manufacturing/expiry date
 - Country of origin
 - Point of sale and shop type
- For each selected product, a new tin of paint was purchased directly from retail outlets to ensure authenticity and prevent prior contamination. From each tin, a portion of the paint was applied uniformly onto clean, square glass slides to create a thin, even layer.
- To minimize cross-contamination, the individually sealed samples were then placed together inside larger secondary ziplock bags before being transported to the analytical laboratory for testing.

4.5. Laboratory Analysis

Following the market survey and sample collection, the laboratory testing process was carried out in accordance with international standards adapted from the **Lead Exposure Elimination Project (LEEP) Standard Operating Procedure**. The procedure ensured accurate, contamination-free preparation, preservation, and analysis of each paint sample to determine total lead concentration on a dry-weight basis.

a. Sample Preparation

To maintain the integrity and comparability of all samples, a standardized preparation procedure was followed for every collected paint tin:

- **Purchase and Identification:**
Each sample tin was purchased directly from retail outlets and labeled with a unique identification code containing information on the **brand name, color, paint type, and collection site**. Photographs of each can were taken to document batch numbers, manufacturing dates, and labeling claims (e.g., “lead-free,” “eco-friendly”).
- **Application on Glass Slides:**
From each tin, a small quantity of paint was drawn using a clean applicator stick and applied evenly on **clean, square glass slides**, forming a thin, uniform layer of approximately **0.5–1 mm** thickness. This ensured sufficient sample volume for subsequent digestion and testing.
- **Drying Process:**
The coated slides were **air-dried under ambient laboratory conditions** for several days in a **dust-free and well-ventilated area**. The drying period typically ranged between **10–14 days**, depending on the paint type, viscosity, and humidity. No artificial heating was used to avoid altering the chemical composition.
- **Film Removal and Storage:**
After complete drying, the paint films were carefully **peeled off the glass slides** using clean tweezers to prevent contamination. Each dried film was then transferred into a **small, individually labeled ziplock bag** marked with the corresponding sample code, brand name, and collection site.
- **Contamination Prevention:**
To minimize cross-contamination, enumerators and lab technicians wore **disposable gloves** while handling each sample. The individually sealed bags were then placed together into a **secondary larger ziplock bag**, functioning as an additional protective layer. All bags were stored in sealed, inert boxes during transport to the testing laboratory.

b. Analytical Method

All samples were analyzed at the internationally accredited lab, **Wisconsin Occupational Health Lab**, using standardized, internationally recognized analytical techniques for lead determination. The laboratory is accredited by the American Industrial Hygiene Association

(AIHA) under the U.S. EPA Environmental Lead Laboratory Accreditation Program and it participates in the Environmental Lead Proficiency Analytical Testing program (ELPAT) operated by the AIHA and established by the U.S. EPA. The laboratory's analytical methods and certifications are consistent with those recommended by the World Health Organisation (WHO) for measuring lead in paint.

- **Sample Digestion:**

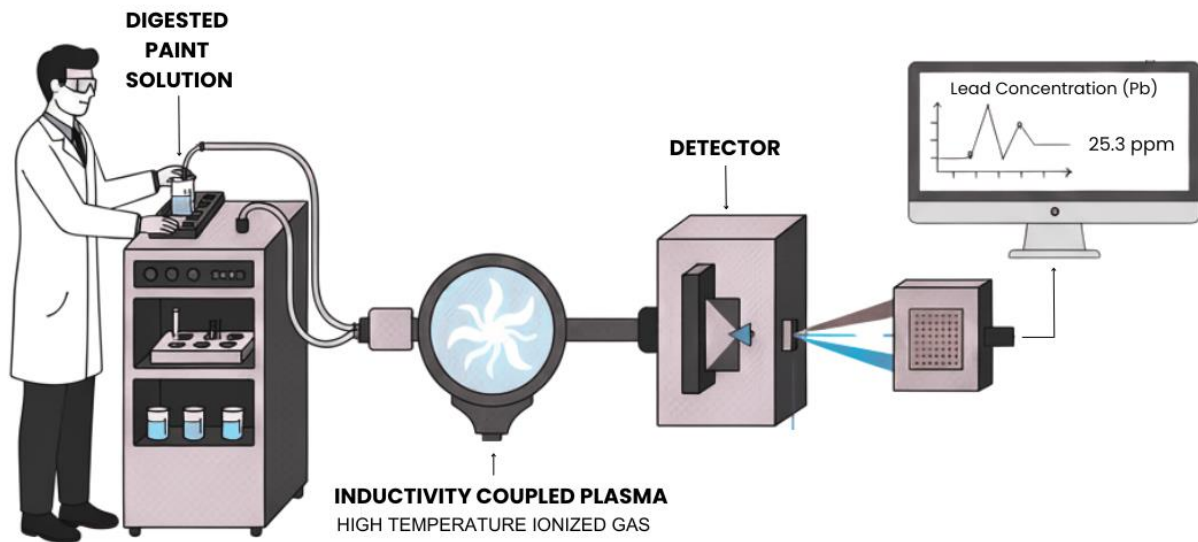
Each paint film was **weighed (dry weight basis)** and digested using a combination of **nitric acid (HNO₃)** and **hydrochloric acid (HCl)** under controlled heat in a **hot block digestion system**. This ensured complete dissolution of the metallic content.

- **Instrumental Analysis:**

The digested solutions were analyzed using **Inductively Coupled Plasma–Optical Emission Spectrometry (ICP-OES)**, following the **NIOSH 7303 method** (NIOSH Manual of Analytical Methods, 4th Edition, 2003). The analysis measured total lead concentration (Pb) in parts per million (ppm) based on the paint's dry weight.

- The reporting limit (RL) for this analysis was **0.0049%**, equivalent to **49 parts per million (ppm)**. This value represents the lowest concentration of lead that can be reliably quantified and reported with confidence under the laboratory's analytical conditions. Any measurement below this threshold would be **considered below the detectable limit (BDL) or not quantifiable with statistical certainty**.

Inductively coupled plasma optical emission spectrometry (ICP-OES) uses a source of inductively coupled plasma (a very high-temperature ionized gas composed of electrons and positively charged ions) to dissociate the sample into its constituent atoms or ions. Under these high-energy conditions, lead (like many other elements) emits light at characteristic wavelengths. The amount of light emitted can be measured and correlated to the concentration of lead in the sample. ICP-OES instruments offer the advantage of being able to determine several elements simultaneously. ICP-OES can measure lead concentrations in paint as low as 2 ppm. Some spectral interferences are common but can be corrected (17). ICP OES instruments must be operated by trained laboratory personnel. The initial instrument cost is high, but the major consumable is only argon gas. Maintenance costs are relatively high because of the complicated design of ICP-AES instruments. Sample throughput is intermediate, typically about one sample per minute.



- **Quality Assurance and Control:**

- Calibration of the instruments was conducted using **certified reference standards** for lead.
- **Blank samples, duplicates, and spiked recovery samples** were included in every batch for accuracy verification.
- All analytical results will be cross-checked with internal BSTI controls and international proficiency standards (AIHA–ELPAT).

- **Reporting and Data Management:**

The laboratory results were reported as **lead concentration (ppm)** for each paint sample. Results were compared against:

- The **Bangladesh Standard (BSTI 90 ppm limit)** for decorative paints.
- International benchmarks from **UNEP** and **WHO** guidelines.

c. Sample Archiving and Disposal

- Paint tins and duplicate dry films were retained at the laboratory for archival reference and potential re-testing.
- Paint tins with lead levels below 90 ppm were considered non-hazardous and safely stored or disposed.
- Paints exceeding 90 ppm were treated as hazardous materials and retained under controlled storage until directed by relevant authorities for proper disposal or return to the manufacturer.

5. Regulatory Review of Lead in Paints:

The regulation of lead in paints represents one of the most effective and achievable interventions for preventing lead exposure worldwide. Paints containing lead pigments and driers have long been recognized as a major and preventable source of human and environmental contamination. When used on household walls, furniture, playgrounds, schools, or industrial surfaces, such paints degrade over time—producing lead-laden dust and flakes that contaminate homes, soil, and air. The result is long-term human exposure, particularly among children, whose developing nervous systems are susceptible to lead’s toxic effects.

Globally, the elimination of lead in paint is now a key target under multiple international frameworks, including the **Strategic Approach to International Chemicals Management (SAICM)**, and the **Sustainable Development Goals (SDG 3.9 and 12.4)**. To support countries in fulfilling these commitments, the **UNEP–WHO Global Alliance to Eliminate Lead Paint (GAELP)** and its **Model Law and Guidance for Regulating Lead Paint** recommend a uniform, legally binding limit of **≤90 parts per million (ppm)** total lead in all paints, regardless of type or use. This global momentum has inspired more than **130 countries** to establish or strengthen lead paint regulations as of 2024.

Within South Asia, progress has been uneven. **India, Nepal, and Sri Lanka** have adopted national standards aligned with the 90 ppm threshold, while the **Philippines** in Southeast Asia stands out for implementing a comprehensive ban covering both decorative and industrial paints, accompanied by certification, labeling, and phase-out mechanisms. In contrast, Bangladesh, though among the early adopters of a 90 ppm standard for decorative paints, still faces critical gaps in scope, enforcement, and inter-agency coordination.

The **Bangladesh Standards and Testing Institution (BSTI)** formally introduced the **BDS 1902:2018** standard, limiting lead in **decorative paints** to **90 ppm**, marking a milestone in aligning with global norms. However, the absence of a legal mandate for **industrial, marine, and automotive coatings**, as well as weak compliance monitoring, has left significant room for lead-containing products to remain in the market. Informal manufacturers and small-scale producers, in particular, continue to operate outside the regulatory perimeter, and imported paints and pigments are rarely screened for lead content at customs.

The purpose of this section is therefore to examine the **regulatory landscape governing lead in paints**—both globally and domestically—and to assess how Bangladesh’s current framework compares with international best practices. This comprehensive review aims to highlight the opportunities for Bangladesh to expand its regulatory coverage, strengthen enforcement mechanisms, and harmonize national standards with global and regional commitments. Ultimately, the findings will guide policymakers, regulators, and industry stakeholders toward developing an integrated, enforceable, and sustainable framework for a **Lead-Free Bangladesh**.

5.1. Global and Regional Context:

Lead Paint Regulation in different countries:

United Kingdom:

To prevent the generation from lead exposure, the ‘Lead Paint Protection against Poisoning, 1927’⁶⁰ has demonstrated the following provisions –

- a. According to this Act, the lead paint means any paint, paste, spray, stopping, filling or other materials used in painting which, when treated in a manner prescribed by rules made by the ministry, yield to an aqueous solution of hydrochloride acid, a quantity of soluble lead compounds exceeding when calculated as lead monoxide five percent of the dry weight of the portion.
- b. Section 1 of the Act states that it is the responsibility of the employers to inspect that the lead paint should not be used or procured for use for the painting of buildings except in the form of raw or dry state. Also, to inspect lead paint shall not be stored at any place otherwise than in receptacles legibly marked as containing lead.
- c. Section 2 said, lead paint shall not be applied in the form of spray in the interior painting of buildings
- d. Section 4 entails that every person associated with lead paint dealing must be provide safety equipment.

USA:

- a. Lead Renovation, Repair and Painting Program Rules⁶¹
This rules aim to protect public from lead-based paint hazards associated with renovation, repair and painting activities. This activities can create hazardous lead dust when surfaces with lead paints. In accordance with the rule, it requires worker to be certified and trained in the use of lead-safe work practices.
- b. Lead-based Paint Disclosure Rule (Section 1018 of Title X)⁶²
Under this rule, the sellers, landlords, property managers, real estate agents must disclose the presence of lead-based paints in houses that build before 1978. The buyers and renter can also request an independent lead inspection.
- c. Consumer Products with Lead⁶³
The Consumer Product Safety Commission has established rules to prohibit unsafe levels of lead in paint and children products.

EU Restriction:

According to the EU’s Registration, Evaluation, Authorization, and Restrictions of Chemicals (REACH⁶⁴) Annex XVII⁶⁵ the manufacturing, distribution of lead paint is strictly prohibited. While the EU has a robust framework against lead in paints but the old buildings during demolition or renovation activities, release a large particle of lead in air. Other than that, the recent report demonstrates though EU banned the use of lead in paint in the member state but it has been exporting the lead chromates to other developing nations where the lead limit is still weak to incorporate.

⁶⁰ https://www.legislation.gov.uk/nisro/1927/129/pdfs/nisro_19270129_en.pdf

⁶¹ <https://www.epa.gov/lead/lead-renovation-repair-and-painting-program-rules>

⁶² <https://www.epa.gov/lead/lead-based-paint-disclosure-rule-section-1018-title-x>

⁶³ <https://www.achhd.org/leadpoisoning/regs.htm#:~:text=If%20you%20participate%20in%20a,://www.cpsc.gov/>

⁶⁴ <https://ipen.org/news/countries-lead-paint-bans-continue-export-key-lead-paint-ingredient-double-standard-puts>

INDIA:

India in 2017, banned the use of lead in decorative or household paint that limited to 90 ppm the regulation called, ‘Regulation on Lead Contents in Household and Decorative Paint Rules ,2016’⁶⁶. According to this rule-

- a. All manufacturers, importers, exporters, and retailers shall abide by the above-mentioned limit.
- b. The paint container must labeled with the safety instructions.

Philippines:

The usage of lead paint is governed by the ‘Chemical Control Order (CCO) for lead and Lead Compounds,2013’. The key provisions are discussing hereafter:

- a. The lead-in paints limit to 90 Ppm for both industrial and decorative paints.
- b. Most important prospects of this order is that it had been planned to gradual phase out of decorative paint within the three years from its commencement. And in case of industrial paint, 6 years from its commencement.
- c. It prohibited the lead paint in the following sectors:
 - Toys
 - School supplies
 - Jewelry
 - Food and Drink Container
 - Cosmetics
 - Other items that adjacent to children
- d. Manufacturers are required to take certification of lead-limit Esurance in the product.
- e. The Environmental ministry is responsible for all kinds of monitoring, penalty and other purposes to ensure the safe future.

5.1.1. SAICM GEF Project - Lead in Paint component

The lead in paint component is part of the SAICM Global Environment Facility (GEF) project⁶⁷, which focuses on addressing emerging chemical policy issues under the Strategic Approach to International Chemicals Management. Alongside components concerning chemicals in products and knowledge management, the project aims to achieve two main outcomes:

- Facilitating legislation in 40 countries to restrict the use of lead paint.
- Encouraging at least 50 small and medium enterprises (SME) paint manufacturers in eight countries to phase out lead from their production processes.

The lead in paint component collaborates with governments to develop lead paint laws and supports SMEs in transitioning away from lead additives. Nationally tailored interventions will demonstrate the adoption of non-lead alternatives using Best Available Techniques (BAT) and Best Environmental Practice (BEP) in SME paint production. By coordinating efforts globally with governments and regional standard-setting organizations, the project seeks to expedite the adoption of legal limits on lead in paint

⁶⁶ https://ipen.org/sites/default/files/documents/Lead%20in%20Paints_2018.pdf

⁶⁷ <https://www.saicm.org/Implementation/GEFProject/LeadinPaintComponent/tabid/7801/Default.aspx>

5.1.2. The Model Law Guidance for Lead Paint

The Model Law Guidance for Lead Paint⁶⁸ typically addresses various aspects related to lead paint standards, aiming to provide a framework for legislation or regulation in this area. Here are some common topics it may cover:

- a. Definition of lead paint: Clear definition of what constitutes lead paint, including acceptable thresholds of lead content in paint products.
- b. Prohibition: Outlining the prohibition or restriction of the manufacture, sale, distribution, or use of lead paint above certain specified levels.
- c. Testing and certification: Establishing requirements for testing and certification of paint products to ensure compliance with lead content standards.
- d. Labeling: Mandating clear labeling of paint products to indicate whether they contain lead and, if so, the concentration of lead present.
- e. Exemptions: Specifying any exemptions or special provisions, such as for certain industrial uses or historical preservation projects, where lead paint may still be used under controlled conditions.
- f. Enforcement: Providing mechanisms for enforcement, including inspections, penalties for non-compliance, and procedures for remediation or mitigation of lead hazards.
- g. Public education and awareness: Promoting public education and awareness campaigns to inform homeowners, contractors, and others about the risks of lead paint exposure and the importance of compliance with standards.
- h. Coordination with other laws: Ensuring alignment with other relevant laws and regulations, such as those related to environmental protection, occupational health and safety, and consumer product safety.

Overall, the Model Law Guidance aims to establish comprehensive and effective measures to minimize the risks associated with lead paint exposure and protect public health and the environment.

5.1.3. The Basel Convention and Lead Paint Waste

The Basel Convention on the **Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1989)**⁶⁹ is directly relevant to lead paint through its regulation of hazardous waste containing lead and lead compounds. Although the Convention does not mention “lead paint” explicitly, it covers paint waste, demolition debris, and residues contaminated with lead pigments or driers.

Under Annex I (Y31: Lead; lead compounds) and Annex VIII (A3020: Wastes containing lead-based paints), any waste containing lead is considered hazardous. Parties are required to ensure environmentally sound management (ESM) of such wastes and to control or prohibit their transboundary movement without prior consent.

For Bangladesh—a Party since 1993—this means that waste from paint removal, discarded paint containers, and obsolete lead-based paints should be treated as hazardous and managed under Basel principles. However, national frameworks such as the Environment Conservation

⁶⁸ <https://www.unep.org/resources/publication/model-law-and-guidance-regulating-lead-paint>

⁶⁹ <https://www.basel.int/portals/4/basel%20convention/docs/text/baselconvention-text-e.pdf>

Rules (1997) and draft Hazardous Waste Management Rules (2023) have yet to explicitly include lead paint waste as a separate category.

Integrating Basel obligations into Bangladesh’s national system would ensure that lead paint elimination efforts address not only the production and sale of lead-based paints but also their safe collection, disposal, and transboundary control, achieving a full life-cycle approach to lead pollution prevention.

5.1.4. The Rotterdam Convention and Lead-Based Paints

The **Rotterdam Convention (1998)** regulates the **international trade of hazardous chemicals** through its **Prior Informed Consent (PIC)**⁷⁰ procedure, ensuring that no hazardous substance is exported without the explicit consent of the importing country.

While the Convention does not directly regulate paints, it covers several lead compounds commonly used as paint pigments, including lead carbonate (white), lead chromate (yellow), and lead chromate molybdate sulfate (orange-red). These are listed in Annex III, meaning their export and import are strictly controlled due to high toxicity. For lead paint elimination, the Rotterdam Convention plays a preventive role by allowing countries to restrict or prohibit imports of such lead-based pigments, thereby cutting off the upstream supply chain for leaded paint production.

Bangladesh, a Party since 1997, can use the PIC mechanism to strengthen its national lead paint regulation—by banning or declining imports of listed lead pigments, improving customs oversight, and aligning national import rules with international trade restrictions on hazardous chemicals.

5.1.5. Lead Paint and the Sustainable Development Goals (SDGs)

Eliminating lead in paints directly supports several targets of the **2030 Agenda for Sustainable Development**, particularly those addressing health, environmental protection, and sustainable production. Under **SDG 3.9**, countries commit to “*substantially reducing deaths and illnesses from hazardous chemicals and pollution*”—a goal to which controlling lead exposure from paints is central. The objective also contributes to **SDG 12.4**, which calls for the “*environmentally sound management of chemicals and wastes throughout their life cycle*.”

Reducing lead releases from paints further aligns with **SDG 6.3** (improving water quality by reducing contamination) and **SDG 11.6** (reducing the environmental impact of cities). Collectively, these goals reinforce the need for strong regulatory frameworks, safer manufacturing practices, and public awareness. Thus, phasing out lead paints is not only a national chemical safety measure but also a key enabler of Bangladesh’s commitments to the global Sustainable Development Goals.

⁷⁰ <https://enb.iisd.org/articles/rotterdam-convention>

5.2. Bangladesh: Current Situation

Bangladesh has made significant strides in establishing a regulatory basis for limiting lead content in paints; however, implementation, enforcement, and coverage gaps continue to pose challenges to full elimination. While standards for decorative paints have been introduced and aligned with the international benchmark of **90 parts per million (ppm)**, **industrial coatings, resins, and primers** remain outside the existing regulatory scope. Furthermore, overlapping institutional jurisdictions, insufficient monitoring capacity, and a lack of harmonized policy integration hinder effective national control of lead in paint and pigments.

5.2.1. Existing Paint Regulations

Until **2018**, Bangladesh had no enforceable limit on lead content in paint or related consumer products such as toys and furniture. This regulatory void allowed both locally manufactured and imported paints containing lead-based pigments and driers to circulate freely in the market.

In response to advocacy from ESDO with the Global Alliance to Eliminate Lead Paint (GAELP), the Bangladesh Standards and Testing Institution (BSTI) introduced mandatory lead standards under the **Statutory Regulatory Order (S.R.O.) No. 221-Law/2018**, approved by the Ministry of Industries.

Bangladesh Standards and Testing Institution (BSTI) ordinance, 1985 (Ordinance No. XXXVII of 1985) Section 24, Sub-section (2) set a standard for lead in paint at **90 ppm**.

This landmark order defines three **Bangladesh Standards (BDS)** for decorative paints, setting a uniform maximum limit of **90 ppm total lead** across categories.

বাংলাদেশ গেজেট

অতিরিক্ত সচিব
কৃষি ও কল্যাণ
ঢাকা, ১০১০

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
শিল্প মন্ত্রণালয়
রাজধানী

তারিখ: ১৯ অক্টোবর ১৯৮৫ বঙ্গাব্দ/০৩ ফাল্গুন ১৩১৩ খ্রিষ্টাব্দ

এস. আর. ও. নং-২২১-সর/১৯৮৫—Bangladesh Standards and Testing Institution Ordinance, 1985 (Ordinance No. XXXVII of 1985) এর section 24 এর sub-section (1) এ বলা অনুযায়ী, সরকার, Bangladesh Standards and Testing Institution এর নীতি পরামর্শক্রমে, শিল্প মন্ত্রণালয় কর্তৃক (১) এ উল্লিখিত পদার্থের জন্য নির্ধারিত কালর (২) এ উল্লিখিত বাংলাদেশ মান (৩) এ উল্লিখিত পদ্ধতিতে যাচাই করা হবে।

২। এই প্রজ্ঞাপন সরকারি গেজেটে প্রকাশের তারিখ হইতে পরবর্তী ২ (দুই) মাস সময়কাল অতিরিক্ত হইবার পরে নিম্ন হইতে কার্যকর হইবে।

স্বাক্ষরিত আদেশক্রমে
অতিরিক্ত সচিব
উপস্থাপিত।

Table 1 Requirements for Enamel, Synthetic, Exterior (a) Undercoating (b) Finishing BDS 1423: 2017 (Clause 3.10)

Sl. No.	Characteristics	Requirements		Methods of Test Ref to IS 191 Annex/ Other Standard
		Undercoating	Finishing	
(i)	Lead content (as Pb), ppm, max	90	90	BDS ISO 6503

Table 1 Requirements for Economy Emulsion paint (Distemper) BDS 1833: 2018 (Clause 4.10)

Sl. No.	Characteristics	Requirements		Method of Test Annex/ Other Standard
(vi)	Lead content (as dry film Pb), ppm, max	90	90	BDS ISO 6503

সেই নামে ডেপুটি, উপ-ডিরেক্টর, বাংলাদেশ সরকারী প্রকাশনা, কেম্পি, ঢাকা কর্তৃক মুদ্রিত।
সেই ডায়েরিতে প্রাপ্ত, উপ-ডিরেক্টর (পরিচালনা বিভাগ), বাংলাদেশ সরকার ও প্রকাশনা অফিস,
কেম্পি, ঢাকা কর্তৃক প্রকাশিত। website: www.bgsti.gov.bd

Standard Code	Title / Paint Type	Lead Limit	Remarks
BDS 1423:2018	Enamel, synthetic, and exterior paints	≤ 90 ppm	For undercoating and finishing applications
BDS 1827:2018	Emulsion paints	≤ 90 ppm	For interior/exterior decorative use
BDS 1833:2018	Economy emulsion paints / distempers	≤ 90 ppm	For low-cost domestic coatings

These standards were developed through BSTI's **Technical Committee on Paints and Allied Materials (TC-18)**, following ISO/ASTM methodologies and guidance from the UNEP Model Law.

However, the regulatory framework's scope remains limited to decorative paints. Industrial categories—such as epoxy enamels, primers, and protective coatings—are not yet included.

Moreover, the standards are not fully legally enforceable, as the SRO provides technical guidance but lacks statutory penalties for non-compliance.

Current Compliance Gaps

- **Monitoring and Testing:** BSTI's laboratory conducts limited sampling, mainly in Dhaka, with minimal market surveillance outside the capital.
- **Manufacturer Reporting:** There is **no legal requirement** for manufacturers or importers to submit periodic compliance data or product samples.
- **Labeling:** Paint cans typically lack labeling indicating lead content, certification status, or batch test results.
- **Retail Availability:** Both compliant and non-compliant products are sold in the same market without differentiation or consumer awareness.

5.2.2. Planning Phase: Standards for Industrial Paints

Recognizing the persistent gaps, BSTI is currently developing new standards to regulate industrial paints and coatings, which are known to be major sources of occupational and environmental lead exposure. These standards, presently under review by the **BSTI Paints and Allied Materials Technical Committee**, will extend coverage to specialized coatings used in construction, shipbuilding, automotive, and heavy machinery sectors.

The proposed standards include:

- **Epoxy Enamel (Glossy)** – typically used for steel structures, pipelines, and vehicles.
- **Two-Pack Epoxy Primer** – anticorrosive base coat with high lead pigment risk.
- **Epoxy Resin Coatings** – widely applied in industrial floors and marine infrastructure.
- **Powder Coatings** – thermoset coatings that may contain lead-based pigments.

These upcoming standards aim to introduce technical specifications and permissible lead limits (≤ 90 ppm) for all industrial categories, aligning Bangladesh's framework with countries like the India, Philippines, Nepal, and Thailand, which have extended controls beyond decorative paints.

Once finalized and gazetted, these standards are expected to:

- Bring industrial coatings under the 90ppm threshold for the first time.
- Require manufacturers to certify compliance and submit samples for testing.
- Enable market surveillance of both local and imported industrial paints.

This policy development marks a significant evolution from consumer-level protection to a full life-cycle approach, addressing occupational and environmental exposure risks from industrial sectors.

5.2.3 Major Regulatory and Institutional Bodies

Bangladesh's regulatory control over lead paint involves multiple ministries and agencies with overlapping mandates. Coordination among them is still evolving.

Institution	Mandate and Role
Bangladesh Standards and Testing Institution (BSTI)	Develops national standards; issues product certifications; operates lead testing laboratories; technical lead on paint standardization (TC-18).
Ministry of Industries (MoInd)	Supervises BSTI; responsible for industrial policy formulation and standard adoption.
Department of Environment (DoE)	Regulates hazardous substances and pollution under the Environment Conservation Act (1995) and Rules (1997); responsible for environmental monitoring.
Ministry of Environment, Forest and Climate Change (MoEFCC)	Focal agency for global chemical conventions (Basel, Rotterdam, Stockholm); coordinates national chemicals and waste strategies.
National Board of Revenue (Customs Wing)	Manages import/export of paint products and pigments; potential enforcement node for restricting import of lead compounds.
Bangladesh Food Safety Authority (BFSA)	Ensures food safety and heavy-metal control in related consumer goods; previously collaborated in enforcement against lead chromate pigments in turmeric.
Consumer Rights Protection Directorate	May act on unsafe consumer products but currently lacks specialized protocols for chemical hazards.

Despite their individual mandates, these institutions operate **in silos**, with no integrated platform for data sharing, inspection planning, or enforcement coordination.

5.2.4 Related Legal Instruments and Policies

Several complementary policies intersect with lead paint regulation, though none provide a fully harmonized framework:

- Environment Conservation Act (1995) and Rules (1997)** – classify lead compounds as hazardous but lack product-level provisions for paints.
- Occupational Safety and Health (OSH) Policy (2013)** – mandates general worker protection but omits chemical-specific exposure standards for paint factories or applicators.
- Import Policy Order (2022–2025)** – does not restrict the import of lead pigments or lead-based raw materials, allowing free entry under generic HS codes.
- Consumer Rights Protection Act (2009)** – allows action against unsafe products but lacks technical benchmarks to prosecute high-lead paints.
- National Hazardous Waste Management Rules (Draft 2023)** – under formulation; not yet inclusive of **lead paint waste** or **lead pigment residues** as separate waste streams.

5.2.5 Paint and Consumer Products

The paint market in Bangladesh remains diverse and partially informal. Industrial coatings such as enamel, primer, and synthetic finishes are routinely marketed as decorative paints without documentation or labeling. The same paint types are used interchangeably in households, public buildings, and playgrounds, increasing the risk of chronic lead exposure among children.

Key observations include:

- Industrial paints are available at retail shops without any **license or usage restriction**, often sold by color name rather than function.
- There is **no color differentiation or hazard labeling**, despite some pigments (especially bright yellow, orange, and red) being strongly associated with lead chromate compounds.
- Retailers and small contractors often **lack awareness** of lead standards, and no requirement exists for **disclosure or recordkeeping** at point of sale.
- Imported paints—especially from regional sources—are rarely inspected or tested for compliance at customs or post-market.

Without a unified regulatory mechanism linking BSTI’s standards to consumer protection and environmental enforcement, lead-containing paints continue to reach end-users in **residential, educational, and public infrastructure settings**, undermining health safeguards.

5.2.6 Enforcement and Laboratory Capacity

BSTI maintains a dedicated **Chemical Testing Laboratory** capable of analyzing total lead in paints using **Atomic Absorption Spectrophotometry (AAS)**. However:

- Testing is limited to a small number of samples annually due to restraining factors such as lack of human resources, financial limitations, lack of technical expertise, primarily during standard development or specific projects.
- There is **no nationwide market surveillance** or random sampling mechanism.
- Laboratories outside BSTI (e.g., DoE, university labs) lack accreditation or standardized analytical procedures for regulatory enforcement.

The absence of a **national compliance monitoring framework**, combined with **limited testing infrastructure**, means that regulatory enforcement remains **reactive rather than preventive**.

5.3. National and Global Regulation Comparison

The regulation of lead in paint has become a central focus of international chemical safety policy, reflecting global recognition of lead’s severe and irreversible impacts on human health—particularly on children’s neurodevelopment. Paints and surface coatings remain one of the most preventable sources of lead exposure worldwide. Over the past decade, governments, industries, and multilateral organizations have moved toward a unified standard: the total elimination of lead compounds from all paint formulations.

At the global level, regulatory progress has been guided by the **UNEP–WHO Global Alliance to Eliminate Lead Paint (GAELP)** under the **Strategic Approach to International Chemicals Management (SAICM)**. The UNEP Model Law and Guidance for Regulating Lead Paint establish a maximum limit of 90 parts per million (ppm) of total lead—the benchmark now adopted or under adoption in nearly half of all countries as of 2024. This harmonization supports broader international commitments under the **Sustainable Development Goals (SDG**

3.9 and SDG 12.4), the Basel and Rotterdam Conventions, and regional chemical safety frameworks.

In contrast, the national regulatory environment varies significantly among countries. High-income economies such as the United States and European Union have long-established comprehensive systems that regulate lead across the entire paint life cycle—from manufacturing and trade of pigments to labeling, consumer protection, and hazardous-waste management. Several emerging economies, including the Philippines, India, and Nepal, have followed with robust legal controls aligning with the 90 ppm threshold and extending it to industrial paints.

Bangladesh, through the Bangladesh Standards and Testing Institution (BSTI), joined this global movement in 2018 by enacting its first enforceable standards (BDS 1423, 1827, and 1833), setting the same 90 ppm limit for decorative paints. This milestone marked an essential step toward compliance with international norms. However, challenges remain: the current framework excludes industrial and protective coatings, lacks explicit enforcement mechanisms, and provides limited consumer labeling or upstream pigment control.

This section presents a comparative analysis of Bangladesh’s national regulatory framework against international and regional best practices. It examines differences in legal scope, limit values, enforcement structures, labeling requirements, import controls, and waste management, highlighting areas where Bangladesh aligns with or diverges from the global standard.

5.3.1. Global Regulation Benchmark

Globally, the elimination of lead in paints has become a recognized chemical safety priority, guided by the UNEP–WHO Global Alliance to Eliminate Lead Paint (GAELP) and the UNEP Model Law, which recommends a uniform maximum limit of 90 parts per million (ppm) total lead for all types of paints—decorative, industrial, automotive, and marine. This 90 ppm threshold has been adopted by leading regulatory systems, including the United States, European Union, Philippines, India, and Nepal, where it is legally binding and enforced through product testing, labeling, and market surveillance.

Countries with mature frameworks, such as the US and EU, regulate lead paint through strict bans, recall powers, and penalties under agencies like the US Consumer Product Safety Commission (CPSC) and EU REACH. Emerging economies, such as the Philippines (DAO 2013-24) and India (2016 Decorative Paint Rules), have also extended the 90 ppm limit to both decorative and industrial paints, coupled with labeling and compliance reporting requirements.

In contrast, Bangladesh adopted the 90 ppm standard only for decorative paints in 2018 through the BSTI S.R.O. 221-Law/2018, establishing standards BDS 1423, 1827, and 1833. While this aligns Bangladesh numerically with the global benchmark, the regulation currently excludes industrial paints, primers, and protective coatings and lacks mandatory labeling, certification, and enforcement mechanisms.

Thus, while Bangladesh has joined the global movement toward lead-free paints, its framework remains partial and weakly enforced compared to international best practices. Expanding the 90 ppm limit to all paint categories, strengthening enforcement powers, and integrating border and waste controls would align Bangladesh more closely with global standards and the objectives of GAELP, SAICM, and the Sustainable Development Goals (SDGs 3.9 and 12.4).

Jurisdiction	Lead Limit (ppm)	Coverage	Legal Enforceability	Labeling/Certification	Monitoring Mechanism
Bangladesh (BSTI BDS 1902:2018)	90	Decorative only	Mandatory	Not mandatory	Limited lab testing
India (2016)	90	Decorative	Legally binding	Required	Periodic market checks
Philippines (2013)	90	Decorative & Industrial	Binding, phased ban	Mandatory	Certification system
Nepal (2019)	90	All paints	Binding	Required	National surveillance
USA (EPA/CPSC)	90	All paints & products	Federal law	Full disclosure	Robust inspections
EU (REACH Annex XVII)	90	All coatings	Binding	Chemical safety sheet	Multi-country enforcement

5.3.2. Comparative Matrix

Pillar	Global best practice	Bangladesh today	What to align
Numeric limit	≤ 90 ppm total lead	90 ppm	Already aligned numerically for decorative.
Scope	All paints: decorative + industrial/automotive/marine	Decorative only (BDS 1423/1827/1833)	Extend to industrial (epoxy enamel glossy, 2-pack epoxy primer, epoxy resin, powder coating) in the new BSTI standards package.
Legal enforceability	Statutory powers for inspection, seizure/recall, penalties	Limited routine market surveillance; No mentionable penalty pathway	Gazette industrial standards with explicit enforcement clauses + joint MoEFCC/MoInd SRO.
Conformity assessment	Mandatory pre-market testing, DoC/CoC, and file retention	Not mandated	Require third-party tests or accredited lab results per batch/period.
Labeling	“Lead-safe ≤90 ppm” or equivalent claims; batch/date	Not required	Introduce labeling rule tied to BSTI certification.

Border controls	Use Rotterdam PIC to restrict lead pigments (lead chromates/carbonates)	Limited pigment tracking; generic HS codes	Issue national PIC decisions; add pigments to Import Policy Order control list.
Waste management	Basel alignment for lead-paint waste	Not explicit; draft rules emerging	Name lead-paint waste and set ESM protocols under hazardous-waste rules.

5.3.3. Regulatory Gap Analysis in Relation to Global Practices

Despite progress toward eliminating lead in paints, Bangladesh’s regulatory framework remains only partially aligned with international best practices. While the Bangladesh Standards and Testing Institution (BSTI) introduced the 90 parts per million (ppm) limit for decorative paints in 2018, significant gaps persist in terms of scope, enforcement, labeling, certification, and coordination. In contrast, countries such as the United States, European Union, Philippines, India, and Nepal have established comprehensive, enforceable systems covering all categories of paints and associated waste. This section examines the key regulatory gaps in Bangladesh’s framework compared to these global standards, identifying areas for policy strengthening and institutional reform.

1. Limited Scope of Existing Standards

Bangladesh’s 2018 paint standards (BDS 1423, 1827, and 1833) introduced the internationally recognized 90 ppm limit but applied it only to **decorative paints**. Industrial coatings, epoxy primers, enamel finishes, and marine or automotive paints—where lead use is often more concentrated—remain **unregulated**. By contrast, the **UNEP/WHO Model Law** and countries such as the **Philippines (DAO 2013-24)** enforce the same limit across both decorative and industrial paints. This limited scope allows industrial paints containing high lead levels to enter the retail market and be used in households, schools, and public facilities without restriction.

2. Weak Enforcement and Compliance Mechanisms

Globally, effective lead paint regulations are backed by legally binding enforcement powers that enable inspections, product recalls, and penalties for violations. In Bangladesh, BSTI’s regulatory framework lacks explicit enforcement provisions, resulting in sporadic market surveillance and limited deterrence. Enforcement agencies do not have the authority to impose fines, confiscate products, or require mandatory compliance testing. This differs sharply from models like the **U.S. Consumer Product Safety Commission (CPSC)** and **EU REACH**, where non-compliant paints are subject to recall, fines, and legal action. As a result, Bangladesh’s compliance relies primarily on voluntary industry participation rather than active regulation.

3. Absence of Mandatory Certification and Pre-Market Testing

In countries aligned with international standards, manufacturers and importers are required to submit pre-market test results or obtain certification from accredited laboratories before products are placed on the market. Bangladesh currently has no mandatory conformity

assessment system, and paint producers are not required to provide test data or certification to BSTI. Compliance is largely self-declared, and testing occurs only when specific concerns arise. This gap undermines consumer confidence and prevents systematic monitoring of compliance trends across the sector.

4. Lack of Labeling and Consumer Disclosure

Mandatory labeling plays a vital role in global regulatory systems by making compliance visible and empowering consumers to make informed choices. For instance, India's **2016 Paint Regulation** requires containers to display "Lead content not exceeding 90 ppm." Bangladesh has no legal requirement for labeling, meaning products sold in the market carry no indication of lead content, batch testing, or safety certification. Without labeling, inspectors, retailers, and buyers cannot distinguish between lead-free and leaded paints, significantly reducing transparency and accountability within the marketplace.

5. Unregulated Import and Use of Lead-Based Pigments

Upstream pigment control is a core element of international lead management under the **Rotterdam Convention**, which regulates the trade of hazardous chemicals through its **Prior Informed Consent (PIC)** procedure. Bangladesh, despite being a Party to the Convention, has not applied PIC provisions to **lead chromate** or **lead carbonate pigments**, which remain legally imported under generic HS codes. This lack of customs-level control enables the continuous supply of raw materials for lead-based paints, particularly among small and informal producers who use cheaper, toxic pigments in local formulations.

6. Inadequate Management of Lead Paint Waste

The **Basel Convention on Hazardous Wastes** requires parties to treat lead-containing wastes—including paint residues, scraped surfaces, and demolition debris—as hazardous materials subject to **environmentally sound management (ESM)**. Bangladesh's **Environment Conservation Rules (1997)** and draft **Hazardous Waste Management Rules (2023)** have not yet explicitly classified **lead paint waste** within their hazardous waste categories. Consequently, waste from paint removal, old infrastructure, or used containers is often discarded in open landfills or informal recycling sites, posing long-term risks to soil and groundwater quality.

7. Fragmented Institutional Coordination

In high-performing regulatory systems, coordination among government bodies is ensured through inter-agency committees or unified regulatory platforms. In Bangladesh, responsibilities are divided among the **BSTI**, **Department of Environment (DoE)**, **Ministry of Industries (MoInd)**, and **Customs**, but no formal coordination mechanism exists for data sharing, joint inspection, or enforcement planning. The absence of a centralized database or a national lead paint registry limits transparency, weakens oversight, and results in duplication or oversight gaps. A multi-agency task force could streamline enforcement and enhance compliance monitoring.

8. Gaps in Public Procurement and Occupational Regulations

Globally, governments often play a leading role in promoting lead-free paints by embedding them in public procurement policies and occupational safety regulations. The **Philippines** and the **United States** restrict the use of leaded paints in government-funded projects, schools, and public infrastructure, while also mandating lead-safe renovation practices. Bangladesh lacks comparable measures; procurement specifications and workplace safety codes do not reference lead content. As a result, even public projects may inadvertently use lead-containing coatings, undermine the goals of the national standard and expose workers to unnecessary hazards.

Overall, Bangladesh’s lead paint regulation is numerically aligned but structurally deficient compared to global standards. The gaps span regulatory scope, enforcement, labeling, pigment control, waste management, and institutional collaboration.

6. Results and Discussion

6.1. Findings from Interviews and Consultations

1. Regulatory and Governance Gaps

- **No enforceable standards exist for industrial paints**, even though decorative paints have a 90 ppm lead limit.
- KIIs revealed that **industrial paints (used in shipbuilding, railways, and construction)** often contain high lead levels because of performance needs (durability, corrosion resistance).
- BSTI and DoE face staff shortages, limited funding, and outdated tools. Many small and informal producers operate outside regulatory supervision.
- Imported paints and raw materials enter the market with minimal inspection, due to weak customs testing and lack of accredited laboratories.

2. Economic and Structural Barriers

- Lead-free production is expensive — raw materials (lead-free pigments and driers) cost **50–70% more** than lead-based ones, according to businessmen in this sector due to 25% customs duty.
- No financial incentives, such as tax rebates, green subsidies, or low-interest loans exist to support safer alternatives.
- Informal producers selling cheap leaded paints **undercut compliant manufacturers**, creating a distorted market.
- Consumers prioritize affordability over safety, especially in rural areas, maintaining high demand for leaded paints.
- KIIs highlighted the absence of domestic R&D for cost-effective lead-free formulas — most technologies are imported, raising production costs.

3. Industrial Practices and Occupational Safety

- Interviews with factory owners and workers showed **limited awareness of health risks** from lead and VOC exposure.
- Protective gear (masks, gloves, ventilation) is rarely used; workers reported irritation, headaches, and fatigue as common occupational symptoms.

- Improper waste disposal is common — sludge and leftover pigments are often dumped into open drains or soil.
- Stakeholder workshops confirmed that paint waste management and recycling facilities are minimal or absent.

4. Infrastructure Deficiencies

- Approximately **30% of the required testing capacity** for lead in paints is operational, concentrated in urban centers (mainly Dhaka).
- No mobile or regional testing units exist, limiting field inspection capacity.
- Customs checkpoints lack **lead detection equipment**, allowing contaminated imports to pass.
- **Waste collection and recycling infrastructure** for hazardous byproducts (e.g., lead dust, sludge) is almost non-existent.

5. Awareness and Stakeholder Understanding

- KIIs and consultations found **low awareness across the value chain** — from raw material suppliers to end-consumers.
- Many sellers are unaware of the 90 ppm regulation; some confuse industrial and decorative categories.
- Largely unaware of health effects or how to identify lead-safe labels.
- Government officers and traders recognize the problem but lack training, funding, and guidelines to act effectively.
- Workshops emphasized the need for **national awareness campaigns**, inclusion of lead safety in education curricula, and training for factory workers.

6. Environmental and Health Implications

- Industrial paints contribute heavily to microplastics and heavy metal pollution, especially in marine and shipyard areas.
- Communities near paint manufacturing sites experience higher respiratory and neurological issues.
- **Lead exposure from paints** is directly linked to decreased IQ in children, kidney damage, and cardiovascular diseases in adults.

6.2. Findings from Market Survey

1. Manufacturing Practices

When asked whether they manufactured paints themselves, the majority of respondents (**36 out of 37 shops**) stated that they do not engage in paint manufacturing. Most shops function solely as **retailers, distributors, or resellers** of established national and imported brands.

2. Export Practices

The survey revealed that most retailers and distributors (**27 out of 37**) do not export paints and operate exclusively within domestic markets. Only a small segment (**10 respondents**) reported engaging in export activities, primarily through indirect channels linked to manufacturing companies or bulk distributors.

Among the few respondents who export, **five identified China** and **four identified India** as their primary export destinations, reflecting the close regional trade networks of the South Asian and East Asian markets. Additionally, **one respondent** mentioned exporting paint products to **South Korea**, mainly for industrial or coating applications.

3. Paint Mixing Practices

Among the surveyed outlets, **20 out of 37 shops** reported that they **mix paints on-site** using **automated color mixing machines or color bank systems** provided by paint companies. These systems allow retailers to customize paint shades according to specific customer preferences, offering greater flexibility in color selection.

The **remaining 17 shops** do not mix paints and instead sell **ready-made colors** supplied directly by manufacturers. Retailers who do mix paints primarily rely on **base paints and various color tints**, which are combined using the machine to produce the desired shade. The use of company-supplied color banks ensures color consistency and helps maintain quality control across outlets.

4. Sale and Use of Industrial Paints

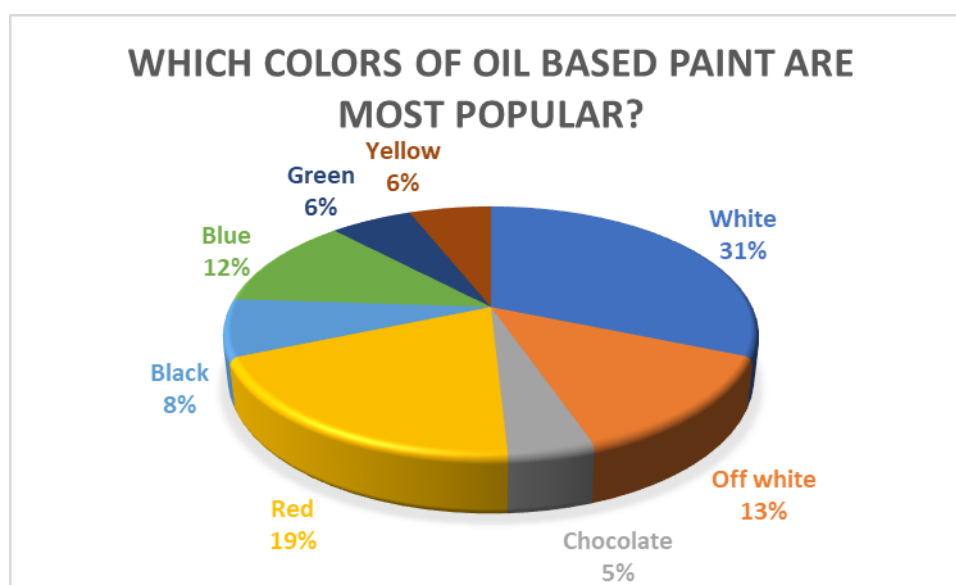
A significant majority of respondents (**approximately 86.5%**) confirmed that **industrial paints are sold alongside decorative paints** in the same retail outlets. These include **automotive paints, enamel paints, and metal coatings**, which are often displayed and sold without clear differentiation from household or decorative products.



Several retailers also reported that certain industrial paints—particularly enamel and automotive types—are frequently purchased by individual consumers for home use, including applications on doors, furniture, and outdoor metal structures. The findings indicate a blurring of boundaries between decorative and industrial paint markets in Bangladesh, primarily due to the absence of labeling requirements or retail restrictions.

5. Popular Colors of Oil-Based Paints

Color preference plays a key role in determining sales trends across Bangladesh’s paint market. The survey results indicate that **white is by far the most popular color**, accounting for **31.8%** of total oil-based paint sales. **Red (19.7%)** and **off-white (13.6%)** follow as the next most commonly sold shades, often used for both residential and commercial applications. Other frequently sold colors include **blue (12.1%)**, **black (7.6%)**, **green (6.1%)**, **yellow (6.1%)**, and **chocolate brown (4.5%)**.



6. Proportion of Oil-Based vs. Water-Based Paint Sales

When asked about the proportion of oil-based and water-based paints sold, responses varied across outlets, reflecting diverse customer preferences and product availability. On average, **oil-based paints accounted for the majority share of sales**, with most respondents estimating that **between 51% and 70%** of their total paint sales fall under this category.

According to the survey, **35.1% of retailers** reported oil-based paint sales within the **51–70% range**, while **24.3%** indicated that oil-based products comprised **31–50%** of their total sales. A smaller proportion **13.5% each**—stated that oil-based paints accounted for **below 30%** or **over 90%** of their sales.

These findings suggest that oil-based paints still dominate the market, driven by their perceived durability and suitability for metal, wood, and industrial applications. However, the increasing presence of water-based paints in urban retail outlets indicates a gradual shift toward safer and environmentally friendly alternatives, particularly in Dhaka’s north and central zones.

7. Perceived Market Share of Paint Manufacturers

When asked about the market share distribution among major paint manufacturers, most respondents reported that they were unaware of exact figures or did not have access to reliable data. However, perceptions collected from the field provide a general indication of brand dominance within Bangladesh’s paint market.

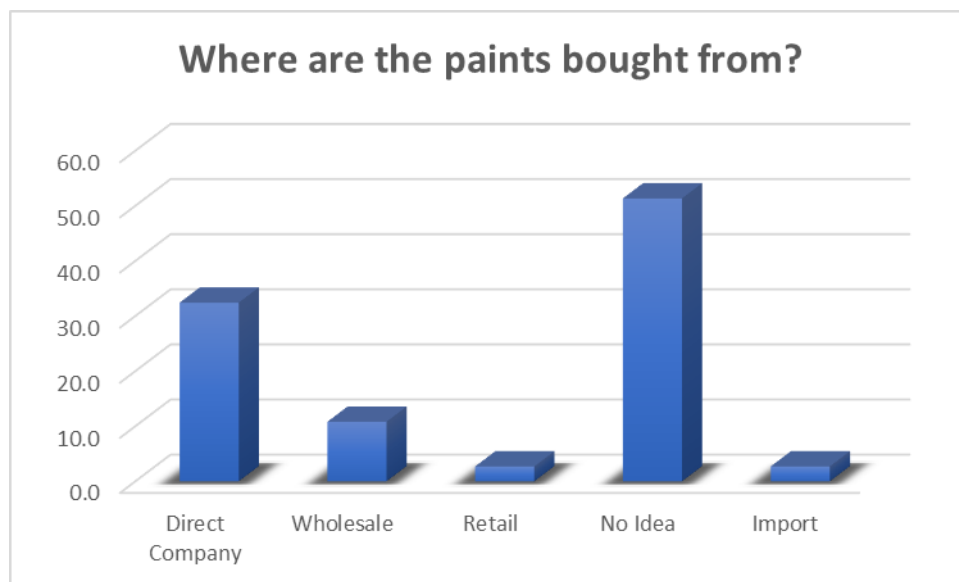
A majority of respondents **16 out of 37 shops (approximately 43%)** identified **Berger Paints Bangladesh Limited** as the **market leader**, consistently citing its wide product range, brand

reputation, and strong nationwide distribution network. An additional **7 respondents (around 19%)** mentioned **Asian Paints**, often alongside Berger, as a key competitor occupying significant retail visibility. Overall, the findings suggest that **Berger and Asian Paints together dominate consumer awareness and market share**, with smaller domestic companies occupying niche or regional segments.

8. Paint Procurement Sources

When asked where they obtain their paint supplies, the responses reflected a strong dependence on direct company distribution networks and limited market knowledge among smaller retailers. Approximately **32.4%** of respondents reported that they purchase paints **directly from manufacturing companies**, indicating the dominance of structured supply chains maintained by major brands such as Berger and Asian Paints.

Meanwhile, **10.8%** of respondents sourced paints through **wholesalers**, and only **2.7%** procured from other **retail outlets**, suggesting that informal resale is uncommon. A small proportion (**2.7%**) indicated **direct imports**, primarily for specialized or industrial paints.

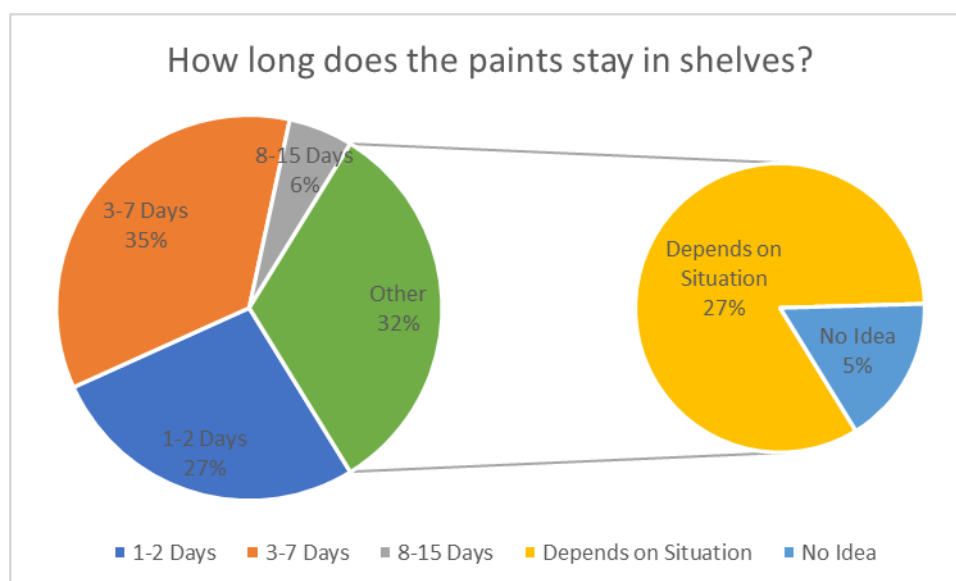


However, more than **half of the respondents (51.4%)** stated that they were uncertain about their supply source, likely due to limited involvement in procurement or a lack of clarity regarding supplier tiers within the distribution chain.

9. Shelf Life and Stock Turnover of Paints

Retailers were asked how long paints typically remain on shelves before being purchased. The majority of responses indicate that paint turnover is relatively quick, reflecting a fast-moving consumer market in major urban areas.

Approximately **35.1% of respondents** stated that paints are sold within **3–7 days** of arrival, while **27%** reported sales within **1–2 days**.



Another **27%** noted that sales duration **varies depending on customer demand, brand, season, and color**, suggesting fluctuations tied to seasonal projects or promotional cycles. A small proportion (**5.4% each**) said that paints may remain in stock for 8–15 days or that they had no clear estimate.

6.3. Findings from Laboratory Analysis:

The primary findings from laboratory analysis revealed a clear distinction between large-scale, branded **multinational** manufacturers and small or local producers in terms of compliance with the 90 ppm lead limit. All major international brands (**Berger, Asian Paints, Nippon**) — including well-established decorative and enamel paint companies operating under BSTI certification were found to be fully compliant with the permissible threshold.

In contrast, Non-compliance was observed across a range of manufacturers, mostly small-scale and locally produced brands, as well as some registered companies. This suggests that gaps in quality control, testing, and enforcement persist across different segments of the industry, not only within unregistered or informal producers.

These paints, primarily **oil-based enamels and spray coatings**, contained lead levels ranging from several thousand to over 100,000 ppm, indicating the continued use of **lead chromate pigments** and lack of production oversight. This pattern confirms that regulatory enforcement and market monitoring should prioritize small, informal producers, who remain the primary source of lead contamination in the Bangladeshi paint market.

6.3.1. Compliance with Lead Standard (≤ 90 ppm Limit)

Out of a total of 161 paint samples analyzed, 68 were found to be non-compliant and 93 were compliant with the national and international benchmark limit of 90 ppm total lead for decorative paints, as defined by BSTI (BDS 1423:2018, 1827:2018, and 1833:2018) and the WHO–UNEP Model Law.

Classification	No. of Samples	Percentage (%)
Below 90 ppm	93	57.8 %

Above 90 ppm	68	42.2 %
Total Samples	161	100 %

Most compliant samples are likely to be from large multinational or established brands. In contrast, the majority of non-compliant samples appear to come from **local or small-scale producers**, which constitute 15-20% (~10% large local producers, i.e., Elite, Rainbow, and Roxy, ~5-10% SMEs of the market share), especially those supplying enamel and industrial-grade paints sold as decorative alternatives.

6.3.2. Top 10 Samples with the Highest Lead Concentrations

Brand Name	Paint Type	Product Description	Color	Lead (ppm)
Kangaroo	Oil/Solvent	Decorative Indoor	Lemon Yellow	190,000
Euro	Oil/Solvent	Decorative Indoor (NC Paint)	Yellow	170,000
Nahar	Oil/Solvent	Decorative Indoor (NC Lacquer)	Yellow	81,000
New Tua	Oil/Solvent	Decorative Indoor (Auto Lacquer)	Yellow	74,000
Top Seal	Spray	All-purpose use	Medium Yellow	54,000
Modina Better Rubilack	Oil/Solvent	Synthetic Enamel	Yellow	19,000
Meghna Plus	Oil/Solvent	Super Gloss Synthetic Enamel	Golden Yellow	18,000
Ramy	Oil/Solvent	Synthetic Enamel	Yellow	18,000
Turkey	Oil/Solvent	Synthetic Enamel	Golden Yellow	16,000

The ten highest-lead paint samples all **exceed the 90 ppm legal limit** by a large margin, ranging from **16,000 ppm to 190,000 ppm**—levels typical of **lead-based pigments** such as lead chromate. Notably, **yellow-toned paints** (lemon, medium yellow, golden yellow) dominate this group, indicating that lead pigments are still widely used to achieve bright yellow shades. The consistent presence of high lead levels in yellow paints suggests that pigment selection is a primary source of contamination in the Bangladeshi market.

6.3.3. Distribution of Paint Samples by Lead Concentration Range

Concentration above 100,000 PPM:

Brand	Paint Type	Color	Lead (ppm)
Kangaroo	Oil/Solvent – Decorative Indoor	Lemon Yellow	190,000
Euro	Oil/Solvent – Decorative Indoor	Yellow	170,000

Concentration between 50,000–100,000 ppm:

Brand	Paint Type	Color	Lead (ppm)
Nahar	Oil/Solvent – Decorative Indoor	Yellow	81,000

New Tua	Oil/Solvent – Decorative Indoor	Yellow	74,000
Top Seal	Spray – All Purpose	Medium Yellow	54,000

Concentration between 10,000–50,000 ppm:

Brand	Paint Type	Color	Lead (ppm)
Modina Better Rubilack	Oil/Solvent – Synthetic Enamel	Yellow	19,000
Meghna Plus	Oil/Solvent – Super Gloss Enamel	Golden Yellow	18,000
Ramy	Oil/Solvent – Synthetic Enamel	Yellow	18,000
Turkey	Oil/Solvent – Synthetic Enamel	Golden Yellow	16,000
Rangs	Oil/Solvent – Super Synthetic Enamel	Yellow	15,000
Royal Auto Spray Paint	Spray – Quick Dry	Medium Yellow	14,000
Magic Paint	Oil/Solvent – Synthetic Enamel	Yellow	12,000
Red Bond	Spray – Brilliant Finish	Art Yellow	12,000
Hayder	Oil/Solvent – Synthetic Enamel	Yellow	11,000
Pailac	Oil/Solvent – High Gloss Enamel	Yellow	11,000
Rock	Oil/Solvent – Synthetic Enamel	Yellow	11,000
Habib Gold	Oil/Solvent – Synthetic Enamel	Yellow	11,000
Gournadi	Oil/Solvent – Synthetic Enamel	Yellow	10,000

Concentration between 1,000–10,000 ppm:

Brand	Paint Type	Color	Lead (ppm)
Jhumur	Oil/Solvent – High Gloss Enamel	White	9,500
Butterfly	Oil/Solvent – Synthetic Enamel	Golden Yellow	9,100
Alfa Paint	Oil/Solvent – Super Gloss Enamel	Yellow	7,600
Micron	Oil/Solvent – Gloss Enamel	Golden Yellow	7,500
M Magic	Spray – Interior/Exterior	Medium Yellow	6,900
777	Oil/Solvent – High Gloss Enamel	Tangerine	6,700
JM	Spray – Acrylic	Medium Yellow	6,500
BD Alpona	Oil/Solvent – Synthetic Enamel	Yellow	6,200
Rauza	Oil/Solvent – High Gloss Enamel	Mid Green	6,200
Anchor Premium	Oil/Solvent – Synthetic Enamel	Red Oxide	4,800
Sunshine	Oil/Solvent – Synthetic Enamel	Yellow	4,100
Dulux	Oil/Solvent – Premium Enamel	Golden Yellow	3,700
Jhalak	Oil/Solvent – Synthetic Enamel	Yellow	3,400

Gournadi	Oil/Solvent – Synthetic Enamel	Red	3,300
Rainbow Spray Paint	Spray – High Gloss	Art Yellow	2,900
Rainbow Rangdhanu	Oil/Solvent – Gloss Enamel	Yellow	2,800
Rauza	Oil/Solvent – High Gloss Enamel	White	2,800
Jhalak	Oil/Solvent – Synthetic Enamel	Tangerine	2,200
Al-Nissan Beta Color	Oil/Solvent – Super Gloss Enamel	White	1,700
Penguin	Spray – Fast Dry	Pink	1,700
Alfa Paint	Oil/Solvent – Super Gloss Enamel	White	1,500
Magic Paint	Oil/Solvent – Synthetic Enamel	White	1,400
Ramy	Oil/Solvent – Synthetic Enamel	White	1,400
Royal Touch Labonno	Oil/Solvent – Synthetic Enamel	White	1,300
Royal Touch QD	Oil/Solvent – High Gloss Enamel	White	1,100
Meghna Plus	Oil/Solvent – Super Gloss Enamel	White	1,000

Concentration between 100–1000 ppm:

Brand	Paint Type	Color	Lead (ppm)
Sunshine	Oil/Solvent – Synthetic Enamel	White	960
Kangaroo	Oil/Solvent – Decorative Indoor	Super White	940
Hafiza OK	Oil/Solvent – Synthetic Enamel	Red	880
Red Bond	Spray – Brilliant Finish	Suzuki Red	860
BD Alpona	Oil/Solvent – Synthetic Enamel	Green	850
Pailac	Oil/Solvent – High Gloss Enamel	Scarlet Red	810
Alfa Paint	Oil/Solvent – Super Gloss Enamel	PO Red	750
Magic Paint	Oil/Solvent – Synthetic Enamel	Red	750
Hayder	Oil/Solvent – Synthetic Enamel	Red	680
Jhumur	Oil/Solvent – High Gloss Enamel	Yellow	630
Gournadi	Oil/Solvent – Synthetic Enamel	White	600
Royal Touch QD	Oil/Solvent – High Gloss Enamel	Red	580
JM	Spray – Acrylic	Cream White	460
Turkey	Oil/Solvent – Synthetic Enamel	White	420
Top Seal	Spray – All Purpose	Suzuki Red	410
Prubal	Oil/Solvent – Synthetic Enamel	Golden Yellow	330
Raaz	Oil/Solvent – Super Gloss	White	320
MSS Korea	Spray – Unspecified	Santana Red	240
Rock	Oil/Solvent – Synthetic Enamel	Red	180
Ramy	Oil/Solvent – Synthetic Enamel	Red	170
Euro Plus	Oil/Solvent – Synthetic Enamel	Teal Blue	170
777	Oil/Solvent – High Gloss Enamel	Signal Red	150
Elite Paint	Oil/Solvent – Synthetic Enamel	Tangerine	110
AMR	Spray – High Gloss	White	110

The frequency distribution shows a concentration clustering between 1,000–10,000 ppm, suggesting partial compliance or substandard reformulation.

Lead Concentration Range	No. of Samples	Share (%)	Description
>100,000 ppm	2	1.2%	Severe contamination (pure lead pigment use)
50,000–100,000 ppm	3	1.9%	Extremely high, often in lacquer-type paints
10,000–50,000 ppm	13	8.1%	High contamination, common in yellow enamels
1,000–9,999 ppm	26	16.1%	Moderate contamination, still hazardous
90–999 ppm	24	14.9%	Low but above the regulatory limit
0-90 ppm	93	57.8%	Compliant within the limit
Total	161	100	—

Over **87% of samples contained more than 1,000 ppm**, which would be considered unsafe even in industrial applications.

6.3.4. Color-Wise Compliance Analysis

Row Labels	Sum of Compliant	Sum of non-compliant	% not compliant
Blue	0	1	100%
Cream	3	0	0%
Gold	3	0	0%
Green	0	2	100%
Grey	1	0	0%
Maroon	1	0	0%
Orange	1	3	75%
Pink	1	1	50%
Red	35	14	29%
White	29	16	36%
Yellow	19	31	62%
Grand Total	93	68	42%

The color-based breakdown reveals clear patterns in contamination levels:

- Yellow and orange paints had the highest rates of non-compliance, with a large share of these samples exceeding the 90 ppm limit.
 - Yellow:** 62% of yellow paints (31 of 50 samples) exceeded the standard.
 - Orange:** 75% exceeded the limit.

These colors are strongly associated with **lead chromate (yellow/orange)** and **lead oxide-chromate (green/blue)** pigments, which are common in oil-based and enamel formulations.

- Red and white paints showed moderate levels of non-compliance, indicating that lead may also be present in some formulations of these colors. In white paints, this may reflect the use of certain drying agents or contamination in the production process.

- **Red:** 29% non-compliant (14 out of 49).
- **White:** 36% non-compliant (16 out of 45).

Red paints often contain **lead molybdate** pigments, while contamination in white shades indicates **cross-contamination** or use of lead dryers (lead naphthenate).

6.3.5. Paint Type–Wise Compliance Analysis

The analysis of lead concentration by paint base type—oil/solvent, water-based, and unspecified (N/A)—shows a strong correlation between paint formulation and regulatory compliance:

a. Oil/Solvent-Based Paints:

Out of 123 oil/solvent-based samples, **56 (46%)** were non-compliant with the 90 ppm standard. This category represents the **highest rate of violation**, confirming that solvent-based enamels and synthetic paints continue to use **lead chromate and other metallic pigments** for brightness and durability.

- **Compliance rate:** 54%
- **Non-compliance rate:** 46%

These paints dominate the local market and are primarily used for indoor and furniture coatings, posing major exposure risks.

b. Water-Based Paints:

All 12 water-based paints tested were **fully compliant (0% non-compliance)**. This confirms that **latex and emulsion formulations**—which use **titanium dioxide and organic pigments**—are generally lead-free. The findings align with global shifts toward water-based, eco-friendly alternatives.

c. Unspecified (N/A) Paints:

Among 26 paints of unspecified or imported spray types, **12 (46%)** were non-compliant. These products often lacked labeling or manufacturer information, suggesting possible **imported aerosol paints** with poor regulation and unknown pigment sources.

6.3.6. Paint Use–Wise Compliance Analysis

The results categorize paints according to their intended use — decorative (indoor/outdoor), external coatings, spray paints, and tints — to understand which application types most often exceed the **90 ppm lead limit**.

a. Decorative Indoor Paints:

This is the dominant category, with **133 total samples (77 compliant, 56 non-compliant)**. About **42%** of indoor decorative paints exceeded the limit, indicating that **home-use synthetic enamels and gloss paints remain a major contamination source**. These products are widely used on walls, furniture, and metal surfaces, thus posing high exposure risks in household environments.

b. Spray Paints:

All **12 spray paint samples (100%)** were **non-compliant**, representing the **worst-performing category**. Spray paints—often imported or unlabeled—contained lead concentrations ranging from **5,000 ppm to over 50,000 ppm**, suggesting the continued use of **lead-chromate pigments** in aerosol formulations. Spray paints are mostly

registered as industrial paints and thus fall outside the remit of existing 90ppm lead regulation, nevertheless these paints are often used for decorative purposes

6.3.7. Country of Origin–Wise Compliance Analysis

This comparison highlights differences in compliance among paints manufactured in Bangladesh and those imported from abroad or of unknown origin.

Country Origin	Compliant	Non-compliant
Bangladesh	77	48
China	8	8
N/A	4	9
Singapore	4	3

1. Bangladesh (Domestic Production):

Out of **125 locally produced samples**, **48 (38%)** were non-compliant. Although **62% met the ≤ 90 ppm limit**, the non-compliant share is still substantial, reflecting **inconsistent quality control** and **limited enforcement** of the BSTI 2018 standard. Non-compliant paints were mostly oil-based yellow and red enamels from **SME or local** producers, representing approximately 15-20% of the market share. The presence of compliant paints from large **multinational** brands demonstrates that lead-free production is technically feasible, but uneven adoption persists

2. China (Imported Paints):

All **16 samples (8 compliant, 8 non-compliant)** indicate **mixed performance**. The 50 % violation rate suggests that **some imported paints do not comply with Bangladesh's 90 ppm limit**, despite China's own national restriction (600 ppm). This points to **lax import screening** and possible inflow of **non-certified batches** through informal channels.

3. Singapore (Imported Paints):

Among **7 samples**, **3** were non-compliant. These likely belong to **specialized or industrial coatings**, which are not covered under the decorative-paint restriction. Although Singapore maintains strict domestic standards, paints exported or re-distributed through regional hubs may fall outside local compliance systems.

4. Unspecified Origin (N/A):

Samples with **no manufacturer or origin labeling** showed the **highest non-compliance rate (69%)**. These are typically **unbranded or repackaged spray and enamel paints**, posing the greatest regulatory challenge since traceability is absent.

7. Recommendations

The findings from ESDO's stakeholder workshops, gap analysis, and industry consultations reveal that protecting public health requires the complete elimination of lead from all paints in Bangladesh. Acknowledging the World Health Organization's (WHO) stance that there is **"no safe level of lead**

exposure," the ultimate goal must shift from simply regulating lead content to achieving a full lead-safe standard. The following multi-pronged and collaborative strategy is proposed to address the regulatory, economic, infrastructural, and awareness-related challenges to achieve this vital objective.

1. Policy and Regulatory Reforms: Mandating a Lead-Safe Future

To create an uncompromising legal framework that prioritizes public health, the following actions are critical:

- Establish a Mandatory Lead-Safe Standard for All Paints
- Include All Paints in BSTI's Mandatory Certification List
- Strengthen Enforcement with a "Polluter Pays" Principle
- Mandate "Lead-Safe" Labeling and Public Disclosure
- Enhance Customs and Border Controls

2. Economic and Financial Incentives: Making Lead-Safe the Viable Choice

To catalyze the transition and support industry, particularly SMEs, the government must implement a robust incentive structure:

- Introduce Aggressive Tax and Fiscal Incentives
- Provide Direct Financial and Technical Support
- Promote Green Public Procurement (GPP)

3. Infrastructure and Technical Capacity Building: Enabling the Transition

Building a lead-safe industry requires foundational support systems:

- Revolutionize Testing and Monitoring Infrastructure
- Develop a Circular Economy for Hazardous Waste
- Boost Research and Development (R&D) for Lead-Safe Alternatives

4. Awareness, Capacity Building, and Stakeholder Collaboration: Building a Lead-Safe Culture

Sustaining this change requires a well-informed and collaborative ecosystem:

- Launch a National "Lead-Safe Bangladesh" Campaign
- Implement Comprehensive Training and Occupational Safety Programs
- Strengthen Multi-Stakeholder Governance

5. Roadmap and Action Plan for Eliminating Lead from Paints in Bangladesh

In alignment with the national "Master Plan for a Lead-Free Bangladesh" led by the Ministry of Environment, Forest and Climate Change (MoEFCC), this document outlines the specific strategy, actions, and timeline for achieving a lead-free paint industry. The ultimate goal, reflecting the WHO's "no safe level" principle, is the full elimination of lead from all decorative and industrial paints.

Overarching Goal:

To establish and enforce a mandatory **lead-free standard** for all paints in Bangladesh, ensuring full market compliance to protect public health, particularly of children, and safeguard the environment.

The Way Forward: A Phased Approach

Phase 1: Short-Term Plan (2025-2026) – Laying the Foundation

The immediate focus is on establishing the legal and technical groundwork for regulating industrial paints and strengthening the framework for decorative paints.

Key Action	Deliverables	Responsible Authority	Timeline
1. Establish Standards for Industrial Paints	A draft policy guideline for a lead-free industrial paint standard.	Lead: Ministry of Industries, BSTI, BPMA Support: ESDO	By 2025
	A report from industry (BPMA) on paint reformulation.	Lead: Ministry of Industries, BSTI, BPMA Support: ESDO, UNICEF	By 2025
	Finalized standard through stakeholder workshops.	Lead: Ministry of Industries, BSTI, BPMA Support: ESDO, UNICEF	By 2025
	A draft document to modify and develop the BSTI standard.	Lead: Ministry of Industries, BSTI, BPMA Support: ESDO, UNICEF	By 2026
2. Develop Fiscal Incentives	A policy brief on tax reforms, including a green tax on lead-containing products and incentives for lead-free alternatives.	Lead: ESDO, UNICEF	By 2025
	National workshop to launch and disseminate tax reform proposals.	Lead: MoEFCC, Ministry of Finance, Ministry of Industry Co-lead: ESDO, UNICEF	By 2026

Phase 2: Mid-Term Plan (2027-2030) – Implementation and Enforcement

This phase focuses on formal adoption of standards, building enforcement capacity, and ensuring initial market compliance.

Key Action	Deliverables	Responsible Authority	Timeline
1. Formalize & Enforce Standards	Endorsement and adoption of lead-free standards for industrial paints (epoxy enamel, primer, resin, powder coating).	Lead: Ministry of Industries, BSTI, BPMA Support: ESDO, UNICEF	By 2030
	Review and update of BSTI regulations for decorative paints to align with a lead-free goal.	Lead: Ministry of Industries, BSTI	By 2030
	A monitoring framework for the updated paint standards.	Lead: Ministry of Industries, BSTI	By 2030
	Enforcement leading to 25% of manufacturers complying with the new standard.	Lead: Ministry of Industries, BSTI	By 2030

2. Monitor the Market & Supply Chain	Identification and listing of non-compliant paint manufacturers.	Lead: Ministry of Industries, BSTI	By 2030
	Situation analysis report on informal paint manufacturers and lead paint products.	Lead: ESDO Support: UNICEF, BAN Toxics	By 2030
	A country report assessing the transboundary movement of lead paint.	Lead: ESDO Support: UNICEF	By 2030
3. Implement Fiscal Policies	Amendment of laws to reduce import duties on lead-free raw materials.	Lead: Ministry of Finance, NBR	By 2028
	Amendment of laws to provide subsidies and financial support for lead-free production.	Lead: Ministry of Finance, NBR	By 2028
4. Build Testing Infrastructure	Establishment of national/regional labs to test lead in paints and other products.	Lead: MoEFCC, Ministry of Health, Ministry of Agriculture Support: World Bank, ADB, UNICEF	By 2030
	Strengthening of mobile testing units at the divisional level for on-the-spot inspections.	Lead: DoE, DGHS, BFSA	By 2030

Phase 3: Long-Term Plan (2031-2035+) – Sustaining a Lead-Free Industry

The long-term vision is to achieve full market compliance, institutionalize monitoring, and foster a self-sustaining, lead-free paint industry.

Key Action	Long-Term Goal
1. Full Market Compliance	100% of paint manufacturers will comply with the lead-free standards.
2. Routine Surveillance	Establish a permanent, routine surveillance system for lead in paints and other consumer products.
3. Continuous Monitoring & Enforcement	Ongoing monitoring and follow-up based on surveillance data by relevant sectors (BSTI, DoE).
4. Advanced Certification	Implementation of third-party certification schemes to verify and endorse lead-free products.
5. Sustainable Fiscal Model	Maintain and refine tax incentives for lead-free products and penalties for lead-based paints to ensure a permanent market shift.

8. Conclusion

This study presents the most comprehensive assessment to date of lead concentrations in paints available in Bangladesh, revealing both progress and persistent challenges in achieving a fully lead-free paint market. Laboratory analysis of 161 paint samples showed that while 57.8% of paints complied with the national 90 ppm standard, 42.2% exceeded the legal limit, demonstrating that lead-based paints remain widely available despite regulatory measures introduced in 2018. The persistence of non-compliant products, particularly among small-scale and informal manufacturers, highlights ongoing weaknesses in enforcement, market surveillance, and public awareness.

Findings from market surveys and stakeholder consultations further highlight structural gaps across the value chain. Informal producers continue to use lead chromate pigments, especially in yellow and red paints, resulting in lead levels as high as 190,000 ppm. Retail surveys revealed that most vendors are unaware of the 90 ppm regulation, and that industrial paints, currently unregulated, are often sold and used for decorative purposes. The study also identified serious deficiencies in labeling, occupational safety, waste management, and inter-agency coordination, all of which perpetuate unsafe production and consumer exposure.

Nevertheless, the results indicate meaningful progress among major national and multinational manufacturers, which have successfully transitioned to lead-free formulations. Their compliance demonstrates that the shift to safer alternatives is both technically feasible and commercially viable, which could be a model for small-scale and informal manufacturers.

To secure and accelerate this progress, Bangladesh must strengthen enforcement of the 90 ppm standard, extend regulation to industrial and automotive paints, and enhance customs inspection for imported products. Equally important are mandatory labeling, routine laboratory audits, public awareness campaigns, and targeted support for small and medium enterprises to adopt lead-free technologies.

In conclusion, eliminating lead from all categories of paints is not only a public health imperative but also an achievable goal. With coordinated policy action, sustained enforcement, and industry cooperation, Bangladesh can eradicate one of the most preventable sources of toxic exposure, protect future generations from irreversible harm, and fulfill its national and global commitments to a lead-free environment under the Sustainable Development Goals (SDG 3.9 and 12.4).



NO SAFE LEVEL

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