

# Global elimination of lead paint

## why and how countries should take action



**Technical brief**



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# Abbreviations

<b>DALY</b>	disability-adjusted life year
<b>GEF</b>	Global Environment Facility
<b>ICCM</b>	International Conference on Chemicals Management
<b>IHME</b>	Institute for Health Metrics and Evaluation
<b>ILO</b>	International Labour Organization
<b>IQ</b>	intelligence quotient
<b>ppm</b>	parts per million
<b>SAICM</b>	Strategic Approach to International Chemicals Management
<b>SDG</b>	Sustainable Development Goal
<b>SMEs</b>	small- and medium-sized enterprises
<b>UNEP</b>	United Nations Environment Programme
<b>WHO</b>	World Health Organization



# Executive summary

This document has been developed for officials in government who have a role in regulating lead paint, to provide them with concise technical information on the rationale and steps required to phase out lead paint. “Lead paint” or “lead-based paint” is paint to which one or more lead compounds have been intentionally added by the manufacturer to obtain specific characteristics. This document explains the health and economic importance of preventing lead exposure by establishing legally binding controls to stop the addition of lead to paint. It also describes the support available to countries to take this action. It is complemented by a policy brief for the information of policy-makers.<sup>1</sup>

## International efforts to eliminate lead paint

Governments are working together to promote policy action to protect human health from exposure to lead. The Global Alliance to Eliminate Lead Paint (the Lead Paint Alliance) was established following the second session of the International Conference on Chemicals Management (ICCM2, Geneva, 11–15 May 2009) under the joint leadership of the United Nations Environment Programme (UNEP) and the World Health Organization (WHO). The primary goal of the Alliance is to promote the global phase-out of lead paint through the establishment of legally binding control measures in every country to limit the lead content of paints, varnishes and coatings. The elimination of lead paint contributes to the achievement of the Sustainable Development Goals (SDGs), in particular SDG targets 3.9 and 12.4.

## Laws are the most effective way to eliminate exposure to lead paint

Legally binding control measures can include statutes, regulations, and/or mandatory technical standards establishing a binding, enforceable limit on lead in paint with penalties for non-compliance. For brevity,

these are referred to in this document as “lead paint laws”. Regulatory controls on a range of sources of lead exposure have been demonstrated to protect public health, as reflected in declining population-level blood lead concentrations in many countries.

## Lead exposure causes wide-ranging health effects and environmental impacts

The toxicity of lead has been known for centuries; however, it is only in recent decades that the impact of chronic low-level lead exposure on multiple body systems has been understood. Studies to date have been unable to identify any level of exposure that has no harmful effects in children or adults. Young children are especially vulnerable to lead toxicity, and even low levels of exposure can result in reduced intelligence quotient (IQ), reduced attention span, increased antisocial behaviour and reduced educational attainment. Exposure in adults is associated with increased risk of cardiovascular disease, including hypertension and coronary heart disease.

As a consequence of these health impacts, the burden of disease from lead exposure is high: the Institute for Health Metrics and Evaluation (IHME) estimated that, in 2017, lead exposure accounted for 1.06 million deaths and the loss of 24.4 million years of healthy life (disability-adjusted life years (DALYs)) worldwide. Lead is, furthermore, a well-documented ecotoxicant, posing threats to both aquatic and terrestrial ecosystems.

## Mechanisms of exposure to lead from paint

Lead compounds can be added to paint as pigments, driers and to provide corrosion resistance, resulting in a high lead content, which may be in the order of thousands of parts per million (ppm). While the paint remains intact, the lead content is not a hazard;

<sup>1</sup> Global elimination of lead paint: why and how countries should take action. Policy brief. Geneva: World Health Organization; 2020.



however, as the paint ages, it starts to crumble and flake, releasing lead into household dust.

Young children are vulnerable to lead exposure from contaminated dust and flaking paint. They spend a lot of time on the ground and ingest lead-contaminated dust through normal hand-to-mouth behaviour. These exposures can result in elevated blood lead concentrations and lead poisoning. Workers can be exposed to lead during paint manufacture, application and removal. If facilities are not available at the workplace for changing clothes and washing, workers may bring lead particles and dust home on their clothing and expose their families.

### **Lead exposure has significant socioeconomic impacts**

Reductions in IQ adversely affect the individual's economic productivity. The potential consequent annual economic losses to society from childhood lead exposure have been estimated at \$977 billion in international dollars,<sup>2</sup> i.e. 1.2% of world gross domestic product at its 2011 value. Other costs include those attributed to criminal behaviour potentially associated with lead exposure, and health-care costs for the treatment of lead poisoning and treatment of cardiovascular and renal disease caused by lead exposure.

### **Eliminating lead paint brings economic benefits**

Countries that continue to permit the manufacture, sale and use of lead paint are creating a legacy of continuing lead exposure and long-term negative health effects. Eliminating lead paint now brings economic benefits in the future, in terms of preventing losses due to reduced productivity and avoiding the costs of the health impacts of lead and of dealing with legacy lead paint to make homes and other premises safe. The costs of dealing with legacy paint have been estimated at between US\$ 193.8 million and US\$ 498.7 million in France and between US\$ 1.2 billion and US\$ 11.0 billion in the United States of America.

### **It is technically and economically viable to produce paints without added lead**

Alternative, non-lead-based ingredients are available that can be used to formulate paint. While there may be some initial investment costs for manufacturers to reformulate their paints, experience has shown that even when increases in the retail price are required, this does not necessarily reduce paint sales in the longer term. Making the change to non-lead ingredients gives paint companies access to markets in countries where the lead content in paint is already restricted, or will be so in future.

### **Why set a limit of 90 ppm for the total lead content in paint?**

There is a well-established chain of evidence linking lead in paint to lead in dust and to elevated blood lead concentrations in children. In view of the long-term health impacts of even low levels of exposure to lead, and the lack of therapeutic interventions to prevent some of these impacts, it is essential to minimize lead exposure from all sources as far as possible. In the case of paint, a limit is needed that is protective but also technically feasible for paint manufacturers. The *Model Law and Guidance for Regulating Lead Paint*, developed by the Lead Paint Alliance, recommends a limit of 90 ppm.

Stopping the addition of lead to decorative paint is a priority because it is the paint to which children are most likely to be exposed. Other age groups should also be protected from lead exposure, hence it is important to regulate the use of lead in all types of paint.

### **Steps towards developing a lead paint law**

Depending on the country and its legal structure and regulatory framework and procedures, the development of an effective lead paint law can be a multisectoral process, involving ministries of health, environment, and trade and economy, standards agencies, the paint manufacturing industry, civil society organizations and the public. The specific activities and legal process required will vary from

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<sup>2</sup> An international dollar would buy in the cited country an amount of goods and services comparable with the amount that a United States dollar would buy in the United States of America (Source: <https://datahelpdesk.worldbank.org/knowledgebase/articles/114944-what-is-an-international-dollar>, accessed 13 April 2020).

country to country, as will the responsible authority. It is essential to ensure the engagement of stakeholders from relevant government ministries, industry and civil society. The draft law should provide accurate technical information, specific limits on lead in paint, information on the authority and responsibilities of government agencies and effective enforcement provisions, and should be followed by a public review. Targeted awareness-raising should be conducted among relevant government ministries, the public, health professionals and industry, on topics including the adverse health and economic impacts of lead, lead paint as a source of exposure, alternatives to lead ingredients in paint and the positive impact of lead paint laws on eliminating lead paint.

Establishing regionally harmonized limits on the lead content in paint and other coatings through regional economic communities can help foster the effective implementation of lead paint laws at the national level and reduce trade barriers among trading partners.

### Support available from the Lead Paint Alliance

The Lead Paint Alliance has developed guidance materials and tools to assist countries in establishing lead paint laws. These include the *Model Law and Guidance for Regulating Lead Paint*, which provides model legal language and guidance on key elements of effective and enforceable legal requirements; a document summarizing the suggested steps towards developing a lead paint law; and a range of awareness-raising and informational materials for local adaptation. More information is available on the Lead Paint Alliance website.<sup>3</sup>

### Conclusions

WHO has identified lead as one of the 10 chemicals of major public health concern globally. While young children are the ones most vulnerable to the toxic effects of lead, in fact all age groups can be adversely affected by exposure to lead. The health consequences of lead exposure can also result in significant negative economic and social impacts at the population level.

Lead paint is an important, but preventable, source of exposure to lead. Already, 72 WHO Member States (73 United Nations Member States) have shown that it is possible to restrict the use of lead in paint, and many paint companies have already reformulated or committed to reformulating their paints. Eliminating lead paint globally is therefore entirely possible and will yield both individual and societal benefits for years to come.

For governments, regulating lead paint is an important primary prevention measure to tackle a priority chemical of public health concern. This action contributes to mainstreaming primary prevention in the sound management of chemicals. It also creates an opportunity for the health and environment sectors to work together to protect public health and preserve the integrity of ecosystems. Such joint activity supports the implementation of the WHO Chemicals Roadmap and the Strategic Approach to International Chemicals Management.



<sup>3</sup> See <https://www.unenvironment.org/explore-topics/chemicals-waste/what-we-do/emerging-issues/global-alliance-eliminate-lead-paint>, accessed 13 April 2020).

# 1. Background

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Lead is a toxic metal that has a long history of use in paint. Paint that contains intentionally added lead is referred to as “lead paint” or “lead-based paint”.

Lead is a human health hazard, and lead paint is a significant source of exposure, in particular for children and workers. The dangers of lead paint have been known for over a century, with the first reports of poisoning in children being published by physicians in Australia and the United States of America in the early 1900s (Gibson, 1904; Rabin, 1989).

Fifty years ago, virtually all paints were based on organic solvents. Such paints are sometimes referred to as alkyd paints or oil-based paints, even though they do not usually contain oil (with the exception of artists’ paints). Lead compounds have historically been added to solvent-based paints to provide colour, speed up drying time, increase durability and resist moisture that causes corrosion. Today, however, it is entirely possible to formulate paint with the desired characteristics without using lead compounds. Safer alternatives to lead compounds used as pigments, driers and anti-corrosives are widely available for use in most solvent-based paints, and many manufacturers, including small- and medium-sized companies, have already stopped using lead ingredients. As another alternative, lead-free water-based paints are increasingly replacing chemical solvent paints in a broad range of paint applications.

Beginning in the 1970s and 1980s, most industrialized countries adopted laws or regulations to severely limit the lead content of decorative paints – paints used on

the interiors and exteriors of homes, schools and other premises. Many countries also imposed controls on other lead paints and coatings, especially those used in applications most likely to contribute to children’s exposure to lead.

While the health hazards of lead paint have long been known, new regulatory action in countries to prevent lead exposure from paint has been stimulated by the recognition of the problem at the global level and the development of global initiatives. Information about the status of regulatory control measures in countries is available from the WHO Global Health Observatory (WHO, 2019a) and is summarized in the UNEP annual *Update on the Global Status of Legal Limits on Lead in Paint* (UNEP, 2019a). However, regulatory action is needed in many more countries. As of December 2019, only 38% of countries had legally binding control measures to prevent the manufacture, distribution, sale and import of lead paint, meaning that in most countries lead paints are still potentially available and in use.

Without legally binding measures to ban the use of lead in paint, lead paint will remain a source of lead exposure and a risk to public health, as well as the integrity of ecosystems. It is more cost-effective to prevent the lead hazard at its source, i.e. to stop the manufacture of lead paint, than to deal with the costly legacy issues of ageing, peeling paint on walls and other surfaces and to manage the adverse health effects on populations exposed to lead from paint.

## 2. Purpose of this document

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This document is intended primarily to assist officials in government who have a role in regulating the safety of paints. It provides information relevant for countries where there are no legally binding controls on lead paint and for those where controls exist, but do not provide sufficient protection. The document provides

the health and economic arguments for eliminating the use of lead in paint, describes how a lead paint law can be developed, and lists the available tools and advice to help countries achieve the elimination of lead paint.





### 3. International efforts to eliminate lead paint

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The first action at the international level to prevent exposure to lead in paint was the International Labour Organization (ILO) White Lead (Painting) Convention, 1921 (No. 13). Under the Convention, Parties undertook to prohibit the use of basic lead carbonate (“white lead”), lead sulfate, and products containing these pigments in the internal painting of buildings, though with some exemptions. The aim of the Convention was to protect the health of workers using these paints. The Convention has been ratified by 63 countries (ILO, 2019). Since, however, the lead compounds banned by the ILO Convention are no longer widely used in paints, the Convention alone provides limited protection against lead exposure.

In 2002, the World Summit on Sustainable Development took two decisions to protect global health from exposure to lead (UN, 2002). One was to support the phasing out of lead from gasoline (UN, 2002, para. 56(b)), and the other was to phase out lead in lead-based paints and in other sources of human exposure (UN, 2002, para. 57).

Subsequently, at the second session of the International Conference on Chemicals Management (ICCM2, Geneva, 11–15 May 2009), lead in paint was identified as one of the eight emerging policy issues nominated for voluntary cooperative risk reduction action by countries under the Strategic Approach to International Chemicals Management (SAICM) policy framework. This decision was based on studies showing that lead paint was still produced and used in many developing countries and countries in economic transition. Governments noted successful efforts to eliminate lead in gasoline through the formation of the Partnership for Clean Fuels and Vehicles and endorsed the establishment of a global partnership to promote the phase-out of the use of lead in paint (SAICM, no date). Governments invited UNEP and WHO to serve jointly as the secretariat of the lead paint partnership, now called the Global Alliance to

Eliminate Lead Paint (short name: the Lead Paint Alliance). The primary goal of the Lead Paint Alliance is to promote the global phase-out of lead paint through the establishment of legally binding control measures in every country to limit the lead content in paints, varnishes and coatings.

Further support for the elimination of lead in paint was provided at the Seventieth World Health Assembly in May 2017, where governments approved the *Road map to enhance health sector engagement in the Strategic Approach to International Chemicals Management towards the 2020 goal and beyond* (decision WHA70(23)), or *WHO Chemicals Roadmap*. The Roadmap includes the phase-out of lead paint as one of the priority actions for governments (WHO, 2017).

In December 2017, the third session of the United Nations Environment Assembly (UNEA-3) adopted resolution UNEP/EA.3/Res.9 on eliminating exposure to lead paint and promoting the environmentally sound management of lead-acid batteries. The resolution provides impetus for countries to adopt laws on the elimination of lead paint.

The elimination of lead paint contributes to the achievement of a number of the targets of the Sustainable Development Goals, in particular:

- target 3.9: by 2030 substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water, and soil pollution and contamination; and
- target 12.4: by 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

## 4. Laws are the most effective way to eliminate exposure to lead paint

As described in Section 3 above, governments around the world have already agreed that lead paint should be phased out to protect human health. The most effective way to do this is for each country to establish legally binding control measures, referred to in this document as “lead paint laws”. Depending on the legal framework in the country, a lead paint law can include statutes, regulations, and/or mandatory technical standards establishing a binding, enforceable limit on lead in paint with penalties for non-compliance (UNEP, 2018). Voluntary control measures are of limited effectiveness because they cannot be enforced.

“Lead paint” is defined by the Lead Paint Alliance in the *Model Law and Guidance for Regulating Lead Paint* (“*Model Law and Guidance*”) as any paint or similar coating material to which one or more lead

compounds have been added (UNEP, 2018). For setting a specific legal limit on lead content, the *Model Law and Guidance* recommends the following language: “Paint and similar coating materials must not contain lead (calculated as lead metal) in excess of 90 ppm of the weight of the total non-volatile content of the paint or the weight of the dried paint film”.

A lead paint law creates strong incentives for change, encouraging paint manufacturers to reformulate their paints, ingredient suppliers to produce more and better non-lead ingredients, and paint importers and distributors to sell paints that comply with the law. Moreover, a strong law creates a fair competitive market for all paint manufacturers, importers and exporters. Where laws are harmonized among countries, this can reduce trade barriers regionally and globally.



The Lead Paint Alliance developed the *Model Law and Guidance* as a resource to help countries establish new laws, or modify existing laws, to limit the lead content in paints. The document includes model legal language and detailed guidance with key elements of effective and enforceable legal requirements, based on the best approaches currently found in lead paint laws around the world. This guidance document is available in Arabic, Chinese, English, French, Russian and Spanish. The rationale for the recommended 90 ppm limit for total lead content is described in Section 11 below. An alternative approach is to establish a set of chemical-specific regulatory limits based on the hazards of individual lead compounds that are used as ingredients in paint (currently used in the European Union REACH regulation<sup>1</sup>). Both approaches have been effective in limiting the lead content in paint.

The *Model Law and Guidance* recommends that the lead content be limited in all types of paint, especially those to which children can be exposed. While there may be a perception that industrial paints are unlikely to be a source of exposure to children, this is not necessarily the case. Industrial paints are used on children's playground equipment, and studies have shown high lead concentrations (Turner & Solman, 2016; da Rocha Silva et al., 2018). Moreover, there are indications that these paints can easily be bought

online and used in the home. While protecting children from exposure to lead from paint is a priority, it should not be forgotten that the manufacture, use and removal of industrial paints are also important sources of occupational exposure to lead, as described in Section 7 below.

There is good evidence that regulating the use of lead is effective in protecting public health. Controls on a range of sources of lead exposure, in particular leaded gasoline, have resulted in significant reductions in lead exposures at the population level. This is reflected in the trend seen in many countries of declining mean population blood lead concentrations (Cañas et al., 2014). In Canada, for example, the 95th percentile blood lead concentration in males decreased from 3.4 µg/dL in 2009–11 to 2.8 µg/dL in 2016–17 and in females from 2.8 µg/dL to 2.2 µg/dL (Health Canada, 2019). In the United States, the 95th percentile values for children aged 1–5 years decreased from 7.00 µg/dL in 1999–2000 to 2.76 µg/dL in 2015–16 (US CDC, 2019). In France, the geometric mean blood lead concentration in 2008–09 in children was 1.5 µg/dL and only around 2% of children had a blood lead concentration above 5 µg/dL (Haut Conseil de la santé publique, 2014). While these figures are very positive, there are segments of the population with higher exposures, for example children exposed to lead paint (Etchevers et al., 2014).

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<sup>1</sup> See the website of European Chemicals Agency at <https://echa.europa.eu/regulations/reach/understanding-reach>.



## 5. Lead exposure causes wide-ranging health effects and environmental impacts

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Lead has no physiological role in the body; however, it has an affinity for sulfhydryl groups and other organic ligands in proteins and can mimic biologically essential metals, such as zinc, iron and, in particular, calcium (USEPA, 2013). As a result of these properties lead exerts multiple types of toxic action and affects almost all body systems (USEPA, 2013). No level of exposure to lead has been identified that does not have harmful effects in children or adults (Lanphear et al., 2005; NTP, 2012; USEPA, 2013).

Acute lead poisoning from a single exposure is rare, while chronic, subclinical poisoning is more common. This is particularly true in the context of lead paint, where poisoning usually arises from the

regular ingestion of small amounts of lead in lead-contaminated dust or paint flakes over a period of time.

The health impacts of chronic low-level exposure include the neurocognitive and cardiovascular effects described below. Even in overt lead poisoning from acute or chronic exposure, the clinical features may be rather non-specific and not initially recognized as being due to lead exposure; they include headache, insomnia, abdominal pain or discomfort, and anorexia with weight loss and constipation. Lead colic (intense, painful, intermittent abdominal cramps) can be mistaken for other conditions, for example appendicitis (Janin et al., 1985). Anaemia may also



occur (USEPA, 2013). As poisoning becomes more severe, life-threatening lead encephalopathy may ensue, with coma and convulsions (Greig et al., 2014; Kosnett, 2007). Children who survive severe lead poisoning may be left with mental retardation and sociobehavioural disorders (Byers, 1959; Tenenbein, 1990).

Young children are especially vulnerable to lead toxicity because the brain and nervous system are still developing and lead interferes with this process (WHO, 2010). Even low levels of lead exposure indicated by blood lead concentrations below 5 µg/dL can result in reduced intelligence quotient (IQ), reduced attention span, increased antisocial behaviour and reduced educational attainment (NTP, 2012; USEPA, 2013). Indeed, studies to date suggest that there may be no threshold of blood lead concentration for neurotoxic effects in children, and that these impacts can be greater at lower blood lead concentrations (< 7.5 µg/dL) than at slightly higher ones (Lanphear et al., 2005).

The neurological and behavioural effects of lead may be irreversible. Longitudinal cohort studies have found that childhood lead exposure is associated with lower cognitive function in adulthood (Mazumdar et al., 2011; Reuben et al., 2017). In a New Zealand study, adults who had a blood lead concentration above 10 µg/dL aged 11 years had an IQ that was 2.73 points lower (after adjustment for covariates) than their peers who had had lower blood lead concentrations. This group also had a socioeconomic status that was a mean of 3.42 units lower (adjusted value) (Reuben et al., 2017).

There is a large body of evidence that even low levels of lead exposure (blood lead concentration below 10 µg/dL) are associated with increased risk of cardiovascular disease in adults, including hypertension and coronary heart disease (USEPA, 2013; Chowdhury et al, 2018; Lanphear et al., 2018). An analysis of data from the Third National Health and Nutrition Examination Survey (NHANES-III) in the United States by Lanphear et al. (2018) estimated that 256 000 deaths per year from cardiovascular disease and 185 000 deaths from ischaemic heart disease were attributable to lead exposure.

Lead exposure may increase the risk of impaired kidney function and chronic kidney disease in adults

(NTP, 2012; USEPA, 2013). High levels of exposure can result in renal failure (Loghman-Adham, 1997).

The reproductive system is also affected by lead exposure, and reduced sperm quality and quantity and increased risk of infertility have been reported (Health Canada, 2013; NTP, 2012; USEPA, 2013). Lead has long been known to adversely affect reproductive outcomes in women. Lead stored in maternal bone from past exposures is mobilized during pregnancy and lactation and re-exposes target organs, as well as exposing the fetus. Maternal exposure to lead, even at low levels, is associated with reduced fetal growth, lower birth weight, preterm birth and spontaneous abortion (NTP, 2012; US CDC, 2010; USEPA, 2013). Delayed onset of puberty in males and females has also been reported (USEPA, 2013).

The health effects of lead described above give rise to a significant burden of disease. The Institute for Health Metrics and Evaluation (IHME) has estimated that, in 2017, lead exposure accounted for 1.06 million deaths and the loss of 24.4 million years of healthy life (disability-adjusted life years –DALYs) worldwide because of its long-term effects on health (GBD 2017 Risk Factor Collaborators, 2018). IHME also estimated that in 2017, lead exposure accounted for 63.2% of the global burden of idiopathic developmental intellectual disability, 10.3% of the global burden of hypertensive heart disease, 5.6% of the global burden of ischaemic heart disease, 6.2% of the global burden of stroke and 3.6% of chronic kidney disease (IHME, 2018).

Beyond its impacts on human health, lead is also a well-documented ecotoxicant, posing threats to both aquatic and terrestrial ecosystems (UNEP, 2010). Studies have shown that forests act as sinks of atmospheric particulates. Atmospheric lead is deposited on foliage and is transported to soil in rainwater or as leaf litter fall. Consequently, organisms in the forest ecosystem can be exposed to particularly high lead concentrations (Zhou et al., 2019). Lead contamination is also known to affect a variety of bird species and to pose a threat to biodiversity (Haig et al., 2014). Aquatic ecosystems including aquatic plants, invertebrates and fish have also been shown to take in lead when present in contaminated water. In fish, for example, lead can have haematological and neurotoxic effects and can disrupt enzyme function, thereby decreasing long-term survival and reproductive success (Demayo et al., 1982).



## 6. Some common sources of lead exposure

Lead has uses in many products and can be naturally present at high levels in mined ores; thus, there are many potential sources of exposure. These include environmental contamination and human exposure from the recycling of lead-acid batteries and from poorly controlled lead mining and smelting operations; the use of traditional remedies containing lead; adulteration or contamination of food; lead ceramic glazes used in food containers; lead pipes and other lead-containing components in water distribution systems; the use of lead in cosmetics and dyes; lead-containing fishing weights and ammunition, and lead paint (WHO, 2019b). Almost all countries have now banned leaded gasoline, so this is no longer a significant source of exposure (UNEP, 2019b).

The widespread use of lead paint, and the fact that it is still permitted in most countries, means that it is an important current and future source of domestic exposure to lead for children. Even in countries where lead decorative paint has been banned, this paint can be found in older premises that predate the ban. Intact lead paint is safe but as it ages, as is inevitable, the paint starts to decay, fragmenting into flakes and dust that contaminate the home and surrounding environment. Studies of lead exposure have shown that the risk of exposure is higher in economically disadvantaged populations living in poor-quality and poorly maintained housing (US Government, 2000).



## 7. Mechanisms of exposure to lead from paint

Individuals can become exposed to lead from paint through occupational and environmental sources. The most important routes of exposure are ingestion – the main route of children’s exposure – and inhalation – the main route of occupational exposure.

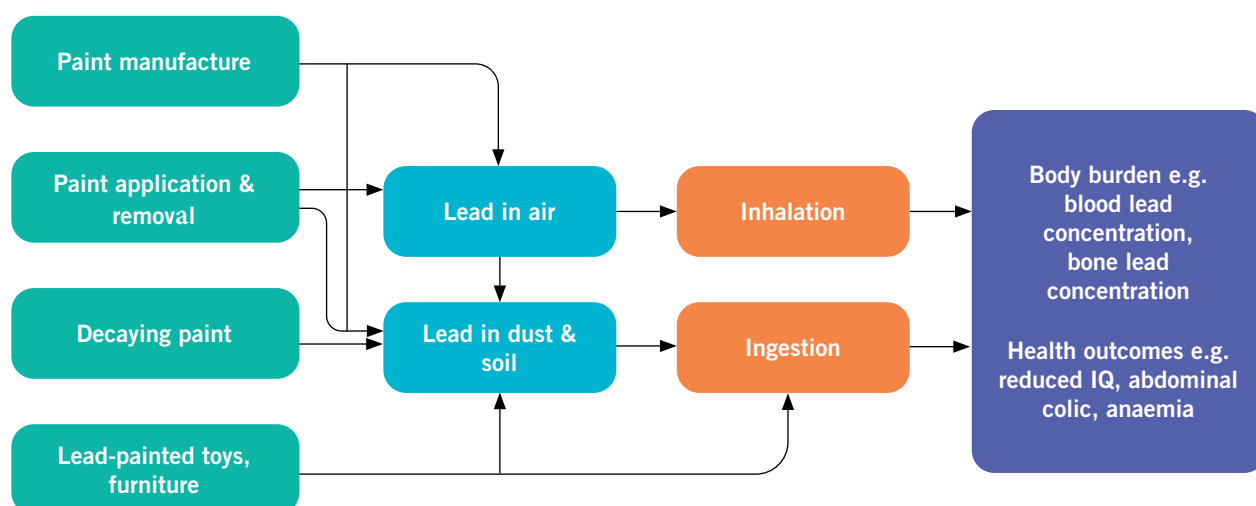
Young children can have a high exposure to lead. They spend more time in a single environment, such as the home, and are often on the ground where they may be in contact with lead-contaminated dust or soil. This can be ingested through the child’s normal hand-to-mouth behaviour (WHO, 2010). In addition, children may mouth, suck or chew on lead-containing or lead-coated objects such as toys and furniture, resulting in lead ingestion. Children with pica may persistently eat flakes of lead paint or lead-contaminated soil (WHO, 2010). A large proportion of the lead ingested by children is absorbed into the body (around 40–50%, compared with around 10% for adults) (Alexander, 1974; Ziegler et al., 1978). Airborne dust can be inhaled.

Lead exposure can occur at any stage of the life cycle of lead paint; this is illustrated in the figure below.

Occupational exposure to lead can occur during paint manufacture, application and removal if the appropriate engineering controls and occupational hygiene measures are not in place, and workers do not have adequate personal protective equipment (Were et al., 2014; Rodrigues et al., 2010). During manufacture workers can be exposed to lead-containing ingredients, which are often in powdered form. In a small study in Kenya, for example, Were et al. (2014) found that workers making paint were exposed to excessively high air lead concentrations and 75.6% had blood lead concentrations above 30 µg/dL. When paint is being applied by spraying or removed through scraping, abrasive blasting, dry sanding or burning, lead particles and fumes are released that are a source of inhalational exposure (Rodrigues et al., 2010). Particles also settle on the skin and clothing of workers and can become a source of ingestion, as well as take-home exposure of workers’ families, if facilities are not available at the workplace for changing clothes and washing.

The manufacture, application and removal of lead paint can also be sources of environmental

**Figure. Pathways and routes of human exposure to lead from paint**





contamination as particles settle in dust and soil. Home renovation activities, in particular, can result in significant lead contamination (US HUD, 2012). Renovation of old furniture can also generate lead dust. The repair and repainting of metal structures and demolition of old buildings can release large amounts of lead particles into the air and on to soil in surrounding areas – this lead can then be blown

or tracked into homes (Caravanos et al., 2006; Lucas et al., 2014).

A further source of environmental contamination is the inappropriate disposal of lead paint or lead-containing raw materials. Disposal of lead-painted wood by burning, or its use for heating, generates lead particles and fumes.



## 8. Lead exposure has significant socioeconomic impacts

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The health effects of lead exposure have an impact at a personal level, including reduced socioeconomic status in adulthood (Reuben et al., 2017), but can also have significant impacts at a societal level, particularly with respect to effects on IQ and behaviour (Bellinger, 2004; Wright et al., 2008).

Reductions in IQ adversely affect the individual's economic productivity. The potential consequent annual economic losses to society from childhood lead exposure have been estimated at \$977 billion in international dollars,<sup>2</sup> i.e. 1.2% of world gross domestic product at its 2011 value (Attina & Trasande, 2013). At the regional level, the estimated losses were (in international dollars): \$134.7 billion in Africa; \$142.3 billion in Latin America and the Caribbean; and \$699.9 billion in Asia (Attina & Trasande, 2013). For comparison, in the United States and Europe, where a range of lead-restriction measures have been

introduced, lead-attributable economic costs were much lower (US\$ 50.9 billion and US\$ 55 billion, respectively), suggesting that the largest burden of lead exposure is now borne by low- and middle-income countries (Bartlett & Trasande, 2013; Trasande & Liu, 2011). Trasande and colleagues have also modelled the economic impact in selected low- and middle-income countries (NYU Lagone Health, 2020).

In France, it was estimated that the costs of criminal behaviour potentially associated with lead exposure amounted to €61.8 million per year (approximately US\$ 68.6 million at 2008 values) (Pichery et al., 2011). Other costs associated with lead exposure include health-care costs for the treatment of lead poisoning and cardiovascular and renal disease caused by lead exposure, and the costs of special education to mitigate lead-induced intellectual impairment.

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<sup>2</sup> An international dollar would buy in the cited country an amount of goods and services comparable with the amount that a United States dollar would buy in the United States of America (Source: <https://datahelpdesk.worldbank.org/knowledgebase/articles/114944-what-is-an-international-dollar>).



## 9. Eliminating lead paint brings economic benefits

Countries that continue to permit the manufacture, sale and use of lead paint are creating a legacy of continuing lead exposure and long-term health effects. Eliminating lead paint now brings future economic benefits in terms of preventing losses due to reduced productivity and avoiding the costs associated with the health impacts of lead and dealing with legacy lead paint to make homes and other premises safe.

Cost estimates are available from France and the United States, which still have substantial housing stocks with lead paint. In France, based on 2008 values, it was estimated that the cost of remediating all homes with lead paint would range from €133.1 million to €342.5 million (US\$ 193.8 million

to US\$ 498.7 million at 2008 exchange rates) (Pichery et al., 2011). In the United States, the cost of remediating lead-painted homes inhabited by young children was estimated to range from US\$ 1.2 billion to US\$ 11.0 billion in 2009 (Gould, 2009).

This investment in remediation has been shown to yield significant economic benefits (Pichery et al., 2011; Gould, 2009); however, its high cost emphasizes the importance of early action to prevent the use of lead paint in the first place. This is particularly important for countries where the paint market is now rapidly expanding and there is still an opportunity to forestall a future problem with lead paint (Kigotho, 2016; Kougoulis et al., 2012; O'Connor et al., 2018).





# 10. It is technically and economically viable to produce paints without added lead

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Paint is made up of four components: resin or polymer binders, pigments/extenders, solvents/thinners and additives to modify the paint's properties, e.g. to speed drying, improve mould resistance and improve corrosion resistance (Kougoulis et al., 2012; Kopeliovich, 2014). The solvents may be water or an organic solvent such as mineral spirits, alcohols or aromatic compounds such as toluene. The term “solvent-based” paint usually refers to paint containing organic solvents.

Some of these components, in particular pigments and the additives that speed drying and ensure corrosion resistance, can be lead compounds. Examples include lead chromate, which is a pigment, lead naphthenate, which is a drier, and lead tetroxide (also called red lead or minium), which is a corrosion inhibitor (UNEP, 2013). There are, however, alternative, non-lead ingredients that can be used to formulate all paints. Indeed, paints without added lead have been on the market for decades in many countries, particularly those countries that have legally binding controls in place (UNEP, 2013). Studies have shown that using non-lead pigments and additives does not necessarily increase the cost of paints, as less ingredient may be needed (Brosché et al., 2014). Moreover, experience has shown that, even when increases in retail price are required, this does not necessarily reduce paint sales in the longer term (IPEN, 2018).

Advances in paint technology mean that modern, water-based paints, often referred to as acrylic emulsions, are increasingly replacing organic solvent-based paints for a broad range of paint applications

and types of surfaces. This has, to some extent, been driven by greater regulation of volatile organic compounds, which are hazardous air pollutants (Gilbert, 2016; Kougoulis et al., 2012). Water-based paints do not usually contain lead compounds, and many companies are now producing lead-free water-based paints for use as architectural paints both indoors and outdoors.

Making the change to using alternatives to lead-based ingredients does require some investment on the part of the paint manufacturer, and this may be a particular challenge for paint manufacturers that are small- and medium-sized enterprises (SMEs). There will usually be a need to develop new formulations that have the desired properties, and some process changes may also be required. Vendors of alternative non-lead ingredients can aid SMEs in reformulating paints using their products. Under a GEF-funded project<sup>3</sup> a set of technical guidelines<sup>4</sup> is being developed to encourage reformulation by SME paint manufacturers, and a number of demonstration projects to verify the technical guidance with SMEs are being conducted in selected countries (NCPC Serbia, 2019). This project is also identifying suppliers of non-lead-based ingredients for use in manufacturing paint.

Despite the initial investment costs, many manufacturers, including SMEs, have already successfully reformulated their products to avoid the use of lead-based ingredients, seeing it as part of their corporate social responsibility to protect workers, consumers and the environment (Curl, 2013; Hunter, 2018; Ongking, 2018; SCS Global Services, 2019).

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<sup>3</sup> GEF: SAICM Full Sized Project with a component focused on “Promoting regulatory and voluntary action by governments to phase out lead in paint”.

<sup>4</sup> See <http://www.saicm.org/Implementation/GEFProject/LeadinPaintComponent/Output11/tabid/7974/language/en-US/Default.aspx> (accessed 13 April 2020).

There is a commercial advantage in making the change to non-lead-based ingredients as this gives paint companies access to markets where the lead content in paint is already restricted. Moreover, the market for lead-containing paint is likely to shrink as more countries introduce lead paint laws. This

is particularly relevant within regional economic communities that have adopted or are seeking to adopt stringent region-wide lead paint standards, e.g. the European Union, the East African Community and the Eurasian Economic Union.



# 11. Why set a limit of 90 ppm for the total lead content in paint?

The Lead Paint Alliance *Model Law and Guidance for Regulating Lead Paint* recommends that the total lead content in paint should be no more than 90 ppm of the weight of the total non-volatile content of the paint or the weight of the dried paint film (UNEP, 2018). The rationale for setting a limit of 90 ppm is based on the established need to minimize exposure to lead to the extent possible (Dixon et al., 2009; Oulhote et al., 2013), while also ensuring that the limit is technically feasible for paint manufacturers to achieve.

## Evidence for lead in paint as a source of human exposure

The exposure pathway linking lead in paint to elevated blood lead concentrations is well established. A chain of evidence confirms that lead paint, particularly when used in homes, contaminates dust and soil, and that contaminated household dust and soil are associated with elevated blood lead concentrations in children and adverse health outcomes (Charney et al., 1980; da Rocha Silva et al., 2018; Dixon et al., 2007; Dixon et al., 2009; Etchevers et al., 2015; Lanphear et al., 1996; Lanphear et al., 1998; USEPA, 2013). In addition, dust and fumes generated by the removal of lead paint have also been shown to expose both workers and inhabitants to lead when proper precautions are not in place (Dixon et al., 2009; Jacobs et al., 2003; Pelclová et al., 2016; Rodrigues et al., 2010; Spanier et al., 2013). Some of the evidence linking lead paint to lead exposure is summarized here.

Lead isotope studies have confirmed that lead paint is a source of lead in household dust (Beauchemin et al., 2011; Glorennec et al., 2010; Rasmussen et al., 2011). Other studies have shown a correlation between high levels of lead in paint and levels of lead

in household dust (Dixon et al., 2007; Jacobs et al., 2003). Dixon et al. (2007), for example, found that a 50% increase in window paint lead was associated with a 5% increase in floor dust lead. Another study found that paint used on exterior railings with a lead loading of 2.6 mg/cm<sup>2</sup> or higher was associated with an approximately 50% higher lead loading in household dust, emphasizing the importance of exterior paint as a source of lead contamination inside the home (Lucas et al., 2014).

Living in a home with lead-contaminated dust is associated with elevated blood lead concentrations. A pooled analysis of 12 studies showed that lead-contaminated house-dust was a major source of intake of lead in children who had blood lead concentrations of 10–25 µg/dL (Lanphear et al., 1998). Lead loadings in floor dust well below 40 µg/ft<sup>2</sup> (430.6 µg/m<sup>2</sup>) are associated with increased blood lead concentrations (Etchevers et al., 2015; Dixon et al., 2009; Lanphear et al., 1996; Lanphear et al., 1998). This value was, until recently, the health-based dust-lead hazard standard<sup>5</sup> for residential floor dust in the United States. In 2019 these standards were reduced from 40 to 10 µg/ft<sup>2</sup> (107.6 µg/m<sup>2</sup>) for floor dust and from 250 to 100 µg/ft<sup>2</sup> (1076.4 µg/m<sup>2</sup>) for windowsill dust to provide better protection for children (US Government, 2019).

Case reports and studies attest to the fact that living or spending time in a home or other premises painted with lead paint can cause lead exposure and sometimes overt, symptomatic lead poisoning (e.g. Talbot et al., 2018; Goldman & Weissman, 2019; Keller et al., 2017; da Rocha Silva et al., 2018; Mathee et al., 2003). The release of lead from paint, the amount of lead in dust and the amount of lead exposure are dependent on a variety of individual factors, such as the age of the paint, the type of lead

<sup>5</sup> The dust-lead hazard standard in the United States is used by risk assessors of lead-based paint to identify hazards that should be remediated.

ingredient, household cleaning routines and child behaviour. It has not, therefore, been possible to make a direct correlation between specific concentrations of lead in paint and the resulting concentrations of lead in household dust and the blood lead concentration and, therefore, directly to quantify the impact of a 90-ppm limit.

There are only limited data relating concentrations of lead in paint directly to blood lead concentrations. A lead isotope study has demonstrated that in homes where the lead loading in paint is above 1 mg/cm<sup>2</sup> this paint can be the source of lead in children's blood (Oulhote et al., 2011). In one small case series, an adult and two young children developed lead poisoning, with blood lead concentrations ranging from 24 to 80 µg/dL, following the abrasive removal of paint that had a soluble lead content of 530 ppm (Pelclová et al., 2016). A study carried out in the United States found that children living in homes where the lead content in paint was 2 mg/cm<sup>2</sup> or higher were nearly six times more likely to have a blood lead concentration above 30 µg/dL in the winter, and nearly 16 times more likely in the summer, than children living in homes without lead paint (Schwartz & Levin, 1991). A further study in children living in homes where the mean lead paint loading ranged from 4.9 to 5.3 mg/cm<sup>2</sup> correlated blood lead concentrations with the paint lead loading and condition index (the measurement by X-ray fluorescence multiplied by a factor of 1 to 3, where 3 indicated poor quality paint condition). The study found that for every 10 mg/cm<sup>2</sup> increase in the paint lead loading and condition index there was a 7.5% higher mean blood lead concentration (Spanier et al., 2013).

### A note about units

The lead content of paint may be expressed as an area concentration (mg/cm<sup>2</sup>) (also known as lead loading) or as a mass concentration (e.g. parts per million (ppm), per cent or µg/g). The area concentration is independent of the thickness of the paint sample, whereas the mass concentration can be affected if, for example, some of the paint layers do not contain lead or if some substrate has been included in the sample, which in both cases would have a diluting effect. For this reason, one cannot readily make a conversion between the two values (US HUD, 2012:Appendix 1.3).

While there may not be data specifically linking a 90-ppm limit on lead in paint with health outcomes, there is evidence that regulatory controls on the lead content of paint reduce the lead content in dust and reduce lead exposure. In the United States and France, older homes have been shown to have higher concentrations of lead in dust than newer homes built after the implementation of regulatory limits on lead in paint. Gaitens et al. (2009), for example, found that homes in the United States constructed after 1978, when the limit on the lead content of new paint for residential and consumer use was established at 600 ppm, had significantly less lead contamination in dust than housing built before 1978 when there was a voluntary limit of 10 000 ppm. A study in France investigated the source of lead in household dust and found that it was only in older homes that interior paint contaminated household dust. In newer homes, paint was not a contributor because the lead content in the paint was low (concentration not stated) (Lucas et al., 2014). Another study in France carried out in 2008–09 found that living in housing built before 1949, when basic lead carbonate was still widely used, was positively associated with a higher blood lead concentration and the effect was stronger in the presence of peeling paint or renovation work (Etchevers et al., 2014). There are other studies that have shown that children living in newer homes decorated with paint without added lead were less likely to have elevated blood lead concentrations (>10 µg/dL) than those living in older homes with lead paint (Dixon et al., 2009; McClure et al., 2016).

Ingestion of paint flakes or chips, particularly when this is repeated, as in children with pica, is a direct pathway of exposure. Where studies and case reports have provided this information, toxic blood lead concentrations were associated with lead concentrations in paint ranging from 1000 ppm to 122 000 ppm (Yaffe et al., 1984; Mathee et al., 2003; Tenenbein, 1990) or less than 5000 ppm (Lavoie & Bailey, 2004).

Some guidance as to what would constitute a hazardous amount of lead in paint is provided by estimates from the American Academy of Pediatrics Committee on Environmental Hazards, which calculated the lead content of 1 cm<sup>2</sup> paint chips according to different lead concentrations in the paint. For paints with a lead content of 10 000 ppm, a 1 cm<sup>2</sup> paint chip was estimated to contain between 65 µg



and 650 µg of lead, depending on the number of layers of paint (range 1–10). For a paint containing 500 ppm of lead, the amount of lead in the paint chip was estimated to be between 3.2 µg and 32 µg (American Academy of Pediatrics, 1972). Using the same calculation, for a paint containing 90 ppm of lead, a 1 cm<sup>2</sup> paint chip would contain 0.6 µg of lead if there was one layer of paint and 6 µg if there were 10 layers.

These numbers may be considered in the context of estimations by the Joint FAO<sup>6</sup>/WHO Expert Committee on Food Additives (JECFA) for dietary exposure to lead. In its review on the toxicity of lead, JECFA found that a mean dietary exposure of 1.9 µg/kg body weight per day in children would result in the loss of 3 IQ points at the population level (JECFA, 2011). As these estimations are based on population-level data, it is not possible to make accurate estimations of health impacts for a single child. However, for illustrative purposes, if the paint contained 500 ppm, then a 10 kg child (approximate age 2 years) would exceed an intake of 1.9 µg/kg body weight by ingesting 6–7 chips of single-layer paint per day. If the paint contained 90 ppm of lead the child would need to ingest around 31 chips of paint per day, which is less likely to occur. This demonstrates the greater protection provided by a 90-ppm limit.

Further support for the need to minimize the lead content of paint is provided by recent assessments of lead as a food contaminant. In 2011, after reviewing dose-response data for the neurodevelopmental toxicity of lead in children and cardiovascular toxicity in adults, JECFA withdrew its provisional tolerable weekly intake value for lead on the grounds that it was not possible to establish a health-protective value (JECFA, 2011). The European Food Safety Authority came to the same decision (EFSA, 2010). The lack of therapeutic interventions that can reverse the effects of lead on cognitive development and other long-term health outcomes is also an important consideration (Dietrich et al., 2004; USEPA, 2013; American Academy of Pediatrics, 2016). These two findings emphasize the importance of the primary prevention of lead exposure, i.e. removal of the source of exposure.

## Applying the evidence to a policy decision on lead paint

As already mentioned, most industrialized countries started adopting laws or regulations in the 1970s and 1980s to severely limit the lead content of decorative paints, as well as paints and coatings used in applications that were likely to contribute to children's exposure to lead. As knowledge has grown about the hazards of chronic low-level exposure to lead and the correlation between lead paint and lead exposure, governments are taking action to lower their maximum limits for lead content in paints and other coatings.

Countries that have enacted laws to limit the lead content of paints and similar coatings have generally used one of two regulatory approaches: either to limit the use of specific lead compounds in paints, as is done in the European Union, or to limit the total lead content in paint from all sources, as recommended in the *Model Law and Guidance for Regulating Lead Paint* (UNEP, 2018). Both approaches can successfully limit the lead content in paint, but in both cases the legal limits should be set as low as possible to be protective of health while also being technically feasible for paint manufacturers to achieve.

The total lead limit of 90 ppm, recommended in the *Model Law and Guidance*, is the lowest existing lead limit for paints in countries around the world. This limit has already been set in a number of countries for some or all types of paints and coatings; these countries include Bangladesh, Cameroon, Canada, China, Ethiopia, India, Iraq, Israel, Jordan, Kenya, Nepal, the Philippines, and the United States (UNEP, 2019a).

As explained in Section 10 above, paints can be formulated without the addition of lead compounds, and the 90-ppm limit is therefore technically feasible. Market studies that test decorative paints for lead content in numerous countries have shown that decorative paints without added lead ingredients are available and have a lead content below 90 ppm. Anticorrosive paints can also be manufactured with a lead content below 90 ppm (SCS Global Services, 2019). Note that a “zero” lead content is not possible because some ingredients, including raw materials from natural sources such as clays and natural pigments, may be contaminated with a small amount

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<sup>6</sup> FAO: Food and Agriculture Organization of the United Nations.

of lead (NCPC Serbia, 2019). Where manufacturers have taken care to source uncontaminated raw materials or those with only trace amounts of lead, it is possible to obtain a lead content significantly below 90 ppm (UNEP, 2013). Conversely, paints with lead ingredients can have a lead content above 100 000 ppm (O'Connor et al., 2018; UNEP, 2013).

Some countries have set lead paint limits at 100 ppm, 600 ppm or higher (UNEP, 2019a). Some countries apply different limits to decorative paints, industrial paints or certain specialized paints. The above discussion suggests that, the lower the concentration of lead in paint, the more this is protective of human health.

Stopping the addition of lead to decorative paint is a priority because it is the paint to which children are most likely to be exposed; however, children can also be exposed to industrial paints used on playground equipment or diverted to household use. Moreover, all

age groups should be protected from lead exposure, including workers who are manufacturing, applying or removing paints.

The 90-ppm lead limit recommended in the *Model Law and Guidance* provides an appropriate goal for all types of paint. Countries may decide to adopt different transition periods for different categories of paint in order to provide a reasonable time for manufacturers to reformulate their products. In the Philippines, for example, a three-year transition period was allowed for decorative paints and a six-year transition for industrial paints before the 90-ppm limit came into force (Environmental Management Bureau, no date). This deadline was accepted and successfully implemented by the Philippine paint industry. If achieving a 90-ppm limit is not yet feasible for a certain specialty use within a reasonable time period, governments are urged to work with stakeholders to discuss how a low lead limit can be met.



# 12. Steps towards developing a lead paint law

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Depending on the country and its legal structure and regulatory framework and procedures, the development of an effective lead paint law can be a multisectoral process, involving ministries of health, environment, and trade and economy, standards agencies, the paint manufacturing industry, civil society organizations and the public. The specific activities and legal process required will vary from country to country, as will the responsible authority.

Establishing regionally harmonized limits on the lead content in paint and other coatings through regional economic communities, such as the Economic Community of West African States, the East African Community, the Eurasian Economic Union and others, can also help foster the effective implementation of lead paint laws at the national level and reduce trade barriers among trading partners.

Some suggested steps are given below based on experiences in countries that have established or are in the process of establishing lead paint laws (UNEP, 2019c).

## A. Seek stakeholder engagement to gain support for a lead paint law

1. Identify the relevant government ministry or ministries whose agreement must be obtained to take action on lead paint laws; these ministries will be key to developing and enforcing a new or revised lead paint law. In various countries, these ministries have included ministries of health, environment and industry, as well as key legislators.
2. Conduct meetings with key civil society and industry stakeholders. In various countries, these stakeholders have included paint manufacturers' associations, researchers and universities and environmental defence groups.

## B. Develop the lead paint law

1. Assess options for the development of a lead paint law:
  - a. review the current regulatory framework to identify existing or required authorities for regulating lead paint;
  - b. decide which ministry or legislative committee will provide leadership for developing a law.
2. Designate the lead agency for drafting legal limitations for lead paint.
3. Facilitate legal drafting:
  - a. establish a drafting coordinating group, including relevant government agencies and stakeholders, as appropriate;
  - b. consider materials such as the *Model Law and Guidance for Regulating Lead Paint* as input to draft laws;
  - c. identify or establish mechanisms for input to this group from key knowledgeable stakeholders from outside government, including industry and civil society.
4. Develop the draft law, including accurate technical information, specific limits on lead in paint, authority and responsibilities of government agencies and effective enforcement provisions.
5. Conduct a public review process as needed and appropriate, based on the country's regulatory development framework.
6. Promulgate the law.



### **C. Conduct awareness-raising to promote the development and implementation of the lead paint law**

1. Identify the appropriate target audience(s) for awareness-raising, which could include relevant government ministries, the public, health professionals and industry.
2. Conduct targeted awareness-raising. Topics could include the adverse health and economic impacts of lead, lead paint as a source of exposure, alternatives to lead ingredients in paint and the positive impact of lead paint laws on eliminating lead paint.



## 13. Tools and advice are available through the Lead Paint Alliance

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The Lead Paint Alliance provides guidance materials and tools to assist countries to establish lead paint laws, and brings together the experience of Alliance partners from various organizations, who will work with countries as available and feasible to support country activities to eliminate lead paint. Tools developed by Lead Paint Alliance partners to support lead paint laws are listed in the annex to this report.

To receive advice from the Lead Paint Alliance, countries are invited to identify the steps and technical advice they need to develop lead paint laws and email [leadpaintlaws@un.org](mailto:leadpaintlaws@un.org) with their request.

The Lead Paint Alliance can provide the following types of advice or information, as available and feasible.

**A. Stakeholder engagement to gain support for a lead paint law**, including advice for convening stakeholder

meetings and help with identifying appropriate stakeholder contacts in local industry and civil society.

**B. Development of a lead paint law**, including legal analysis of the country's regulatory framework to determine existing or needed authorities for regulating lead paint and review and feedback on a draft lead paint law, provided via email or telephone.

**C. Understanding the situation with lead paint in the country**, including providing technical information on reformulation or available paint testing data on lead content.

**D. Awareness-raising to promote development of a lead paint law**, including the provision of existing WHO information on health impacts of lead exposure or Lead Paint Alliance information on the recommended regulatory limit on lead in paint, coordination or advice for conducting awareness-raising events.

# 14. Conclusions

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In recent decades, much has been learned about the toxicity of lead, with studies to date failing to identify a threshold below which there are no harmful effects on human health. Consequently, WHO has identified lead as one of the 10 chemicals of major public health concern globally (WHO, 2019b). Young children and pregnant women are the ones most vulnerable to the toxic effects of lead; however, all people can be adversely affected by exposure to lead. The health consequences of lead exposure can also result in significant negative economic and social impacts at the population level.

Lead paint is an important source of exposure, especially for children but also occupationally. Yet this is entirely preventable by stopping the manufacture and sale of such paint. While the dangers of lead paint were recognized over a century ago, it is only in the last decade that there has been real international momentum to tackle this hazard. This has led to the formation of the Global Alliance to Eliminate Lead Paint to promote and support action by countries to develop lead paint laws.

Already 72 WHO Member States (73 United Nations Member States) have shown that it is possible to implement policies to restrict the use of lead in paint (WHO 2019a; UNEP, 2019a). Many paint companies have already reformulated or committed to reformulating their paints (Curl, 2013; Ongking, 2018). Eliminating lead paint globally is therefore entirely possible and will yield both individual and societal benefits for years to come.

For governments, regulating lead paint is an important primary prevention measure to tackle a priority chemical of public health concern. From a strategic perspective, this action contributes to mainstreaming primary prevention in the sound management of chemicals. It also creates an opportunity for the health and environment sectors to work together to protect public health and preserve the integrity of ecosystems. Such joint activity supports the implementation of the *WHO Chemicals Roadmap* (WHO, 2017) and the *Strategic Approach to International Chemicals Management* (SAICM, no date).



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# Annex. Tools and materials to support the development of lead paint laws

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Lead Paint Alliance partners have developed a number of information resources and tools to support awareness-raising about lead paint and the development of lead paint laws, which are listed below. Many of these are available in multiple languages.

## Awareness-raising

### **International Lead Poisoning Prevention week resource pack and campaign materials**

This webpage provides access to English language materials and links to campaign webpages in Arabic, Chinese, French, Russian and Spanish.

[https://www.who.int/ipcs/lead\\_campaign/en/](https://www.who.int/ipcs/lead_campaign/en/)<sup>7</sup>

### **Lead infographics**

These infographics can be used with social media and highlight the sources of exposure to lead and the health effects.

Arabic: <https://www.who.int/phe/infographics/lead/ar/>

Chinese: <https://www.who.int/phe/infographics/lead/zh/>

English: <https://www.who.int/phe/infographics/lead/en/>

French: <https://www.who.int/phe/infographics/lead/fr/>

Russian: <https://www.who.int/phe/infographics/lead/ru/>

Spanish: <https://www.who.int/phe/infographics/lead/es/>

### **Short video: four things you should know about lead**

This 2-minute video animation explains why lead and, in particular, lead paint is harmful to children and the need for countries to take action to stop this source of exposure.

English: <https://youtu.be/GTcZEAyxhDo>

French: <https://youtu.be/tXkDmu7AJec>

Russian: <https://youtu.be/8vBQ78K3H9A>

Spanish: <https://youtu.be/v-HGfjJthH8>

### **WHO fact sheet: Lead poisoning and health**

This fact sheet describes the health impacts of lead and the need to take action to prevent lead exposure. This weblink is to the English language version and there are links to the factsheet in Arabic, Chinese, French, Russian and Spanish.

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

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<sup>7</sup> All links accessed on 13 April 2020.



## Developing a lead paint law

### **Model Law and Guidance for Regulating Lead Paint (UNEP, 2018)**

A resource to help countries establish new laws, or modify existing laws, to limit the lead content in paints. It includes model legal language and detailed guidance with key elements of effective and enforceable legal requirements, based on the best approaches currently found in lead paint laws around the world. Available in Arabic, Chinese, English, French, Russian and Spanish.

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

### **WHO Global Health Observatory: Regulations and controls on lead paint (website)**

An interactive map showing the status of lead paint laws around the world.

[https://www.who.int/gho/phe/chemical\\_safety/lead\\_paint\\_regulations/en/](https://www.who.int/gho/phe/chemical_safety/lead_paint_regulations/en/)

### **Update on the Global Status of Legal Limits on Lead in Paint (UNEP, 2019a)**

A report describing the status of lead paint laws in countries as of October 2018.

[https://wedocs.unep.org/bitstream/handle/20.500.11822/30110/2019\\_Global\\_Update.pdf?sequence=1&isAllowed=y](https://wedocs.unep.org/bitstream/handle/20.500.11822/30110/2019_Global_Update.pdf?sequence=1&isAllowed=y)

### **Toolkit for Establishing Laws to Eliminate Lead Paint (website)**

A collection of materials for advocacy and technical support for the elimination of lead paint.

<https://www.unenvironment.org/toolkit-establishing-laws-eliminate-lead-paint>

### **Steps Toward Laws (UNEP, 2019b)**

A fact sheet that outlines steps which have been helpful in countries that have adopted laws. The steps are not necessarily sequential or needed in every country. Available in Chinese, English, French, Russian and Spanish.

<https://www.unenvironment.org/resources/factsheet/suggested-steps-establishing-lead-paint-law>

### **UNEP SAICM GEF Project – Lead in Paint component (website)**

Materials from regional lead paint workshops and other project activities of the GEF project component on lead in paint, which is working with governments to support the development of lead paint laws and SMEs to promote the phase-out of the use of lead additives.

<http://www.saicm.org/Implementation/GEFProject/LeadinPaintComponent/tabid/7801/language/en-US/Default.aspx>

## Technical information

### **Brief guide to analytical methods for measuring lead in paint (WHO, in press)**

Outlines the various methods available for measuring lead in existing paint and new paint. Available in Chinese, English, French and Spanish.

[https://www.who.int/ipcs/assessment/public\\_health/lead/en/](https://www.who.int/ipcs/assessment/public_health/lead/en/)

### **Brief guide to analytical methods for measuring lead in blood (WHO, in press)**

Outlines the various methods available for measuring lead in blood in order to assess lead exposure. Available in Chinese, English, French and Spanish from this webpage:

[https://www.who.int/ipcs/assessment/public\\_health/lead/en/](https://www.who.int/ipcs/assessment/public_health/lead/en/)

### **Lead levels in paint around the world (website)**

This map, published by the International Pollution Elimination Network, summarizes the results from paint studies conducted since 2009.

<https://ipen.org/projects/eliminating-lead-paint/lead-levels-paint-around-world>

### **Economic costs of childhood lead exposure in low- and middle-income countries (website)**

This website provides estimates of the economic costs linked to childhood lead exposure in low- and middle-income countries, based on research and modelling by the Division of Environmental Pediatrics at New York University, United States of America.

<https://med.nyu.edu/departments-institutes/pediatrics/divisions/environmental-pediatrics/research/policy-initiatives/economic-costs-childhood-lead-exposure-low-middle-income-countries>

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