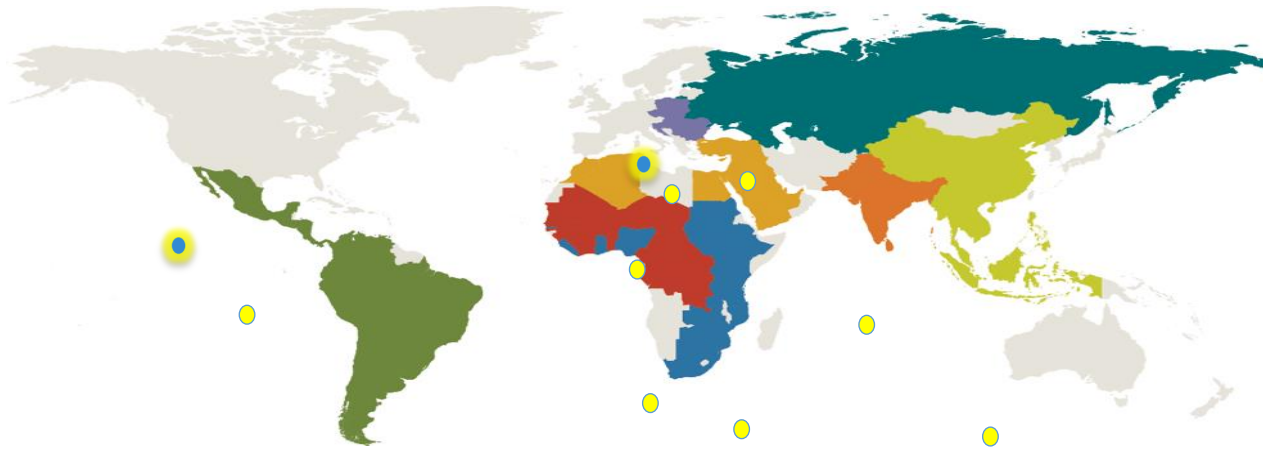


Sampling and Analyzing Paint

Presentation based on Toolkit Module C.ii.

IPEN - A Global NGO Network



700 NGOs in more than 100 Countries working on:

Thematic areas:

- ✓ **Chemical conventions**
- ✓ **Safe Chemicals Management (SAICM)**
- ✓ **NGOs, governments, private sector**
- ✓ **Global, regional, national, community levels**

Outline

- Reasons for analysing the lead content of paint
- New paint: Options for laboratory analysis of total lead content
- Using lead paint analyses to investigate the market for new paints
- Summary, References and Contacts

Reasons for analysing the lead content of paint

New paint for sale:

- Assess the availability of lead-containing paint in the market and the need for better government regulation and enforcement
- Provide consumers with information so they can choose non-lead paint and can push for government controls on lead paint
- Draw attention to companies that produce lead-containing paint and encourage them to voluntarily reformulate their products

Existing paint on structures:

- Assess potential sources of exposure to lead from existing paint on structures, e.g. in homes, schools, hospitals, and playgrounds, and the possible need for mitigation measures



a toxics-free future

Methods for measuring lead in new paint prior to use

Laboratory analysis

- Three main methods
- Results typically reported in ppm, % or mg/kg.

100 ppm = 0.01% = 100 µg/g = 100 mg/kg

Portable X-ray fluorescence (XRF) analysis on prepared samples of the new paint

- Samples needs to be prepared on homogeneous substrate, e.g. wood
- Only one specific XRF model can be used for this purpose
- Lead content is reported as mg/cm²



a toxics-free future

Toolkit Module C.ii. contains information on methods to analyse lead in existing painted surfaces

Laboratory analysis: Three Optional Methods

Three commonly used methods are (in order of higher to lower limit of detection):

1. Flame Atomic Absorption Spectrometry (FAAS)
2. Graphite Furnace Atomic Absorption Spectrometry (GFAAS)
3. Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)

Regulatory Considerations

- Lead paint formulations and existing regulatory standards for lead in new paint are usually expressed as a percentage (%) or as parts per million (ppm), though some regulatory standards use milligrams per kilogram (mg/kg)

$$100 \text{ ppm} = 0.01\% = 100 \mu\text{g/g} = 100 \text{ mg/kg}$$

- Regulations typically specifies a range of accepted international standards for sample preparation and test methods (see next slides)



a toxics-free future

International standards for sample preparation

- **ISO 1513**, Paints and varnishes - Examination and preparation of test samples
- **ASTM E1645-01**, Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis
- **ASTM E1979-12**, Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead



a toxics-free future

International standards for test methods

- **ISO 6503**, Paints and varnishes - Determination of total lead - flame atomic absorption spectrometric method (For measurement of lead concentration of 0.01% to 2.0%)
- **ASTM D3335-85a(2014)**, Standard test method for low concentrations of lead, cadmium, and cobalt in paint by atomic absorption spectroscopy (For measurement of lead concentration of 0.01% to 5.0%)
- **ASTM E1613-12**, Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques (Measurement of lead concentration differs per analytical technique)



a toxics-free future

Laboratory analysis: Some quality considerations

- Trained personnel and good quality assurance procedures are essential to ensure accuracy and reliability of results
- Laboratory should participate in a proficiency-testing scheme, e.g. the Environmental Lead Proficiency Analytical Testing (ELPAT) program
- Laboratory's experience in lead paint analysis (a lab typically needs time to get the method right)
- Analytical methods used (e.g. FAAS, GFAAS, ICP-AES) and Limit of detection
- Specific sample requirements that the chosen laboratory may have



a toxics-free future

Portable High Definition X-ray Fluorescence (HD XRF)

- Uses an x-ray tube to detect and measure lead (needs trained operator)
- Currently, only one model is accurate enough to measure total lead content in parts per million (ppm), at levels lower than 90 ppm
- Equipment is relatively expensive (around 50,000 USD) but is faster and will be cost-effective if a large number of paints needs to be analysed
- Can be used for samples of new paint, if they are prepared on a smooth, flat, homogeneous surface, such as wood



Data available for the region

Country	Year of Study	Number of Paints	Percent Greater Than 90 ppm (Number)	Percent Greater Than 10,000 ppm (Number)	Maximum lead content (ppm)	Ref
Armenia	2011	26	77% (20)	38% (10)	130,000	[1]
Azerbaijan	2013	30	77% (23)	7% (2)	20,000	[2]
Belarus	2009	22	82% (18)	9% (2)	59,000	[3]
Kazakhstan	2011	26	81% (21)	38% (10)	71,000	[1]
Kyrgyzstan	2013	30	67% (20)	10% (3)	99,000	[2]
Russia	2011	21	76% (16)	19% (4)	53,000	[4]

[1] Clark, C.S., et al., *Examination of lead concentrations in new decorative enamel paints in four countries with different histories of activity in lead paint regulation*. Environmental Research, 2014. **132**: p. 233-243.

[2] UNEP and IPEN; *Lead in Enamel Decorative Paints; National Paint Testing Results: A Nine Country Study*, 2013:

[3] Toxics Link and IPEN; *Lead in New Decorative Paints; 2009*:

[4] Clark, C.S., et al., *Total lead concentration in new decorative enamel paints in Lebanon, Paraguay and Russia*. Environmental Research, 2015. **138**(0): p. 432-438

New Studies in 2016

1. Armenia
 2. Georgia
 3. Moldova
 4. Belarus
 5. Ukraine
 6. Kazakhstan
 7. Kyrgyzstan
 8. Russia
 9. Tajikistan
- Already ongoing studies
 - 25-50 paints will be analyzed for total lead content
 - The results will give an updated picture of the situation in the region
 - The results will be publically released, and provide stakeholders with information to act



Using lead paint analyses to investigate the paint market

Conducting a market survey of lead content in new paint for sale

- Provides information about the extent of the problem that lead paint presents in a country and the need for regulatory or enforcement measures.
- Important to ensure that tested products are representative of all major brands and include a range of colors:
 - brightly colored paints, e.g. yellow, red, orange, green, typically contain the highest levels of lead
 - include a white paint from each brand
- Useful to link data about lead content of paints to information about the manufacturers selling paint on the national market



*Photo Credit:
Andrei Isac, EcoContact,
Moldova*

Linking analytical data to paint market information

- Relevant information includes:
 - available brands on the market, both locally-produced and imported products
 - size of manufacturer and relative sales volume
 - Information on paint-can labels about ingredients, hazard warnings about lead, or statements indicating low lead content

Linking analytical data to paint market information (continued)

- This information can be used:
 - as evidence when enacting and enforcing regulations on production, export / import, sales and use of paint with added lead
 - to show the need for including a labeling requirement in the regulation
 - in outreach to industry stakeholders for dialogue about regulatory controls on lead paint
- More information is available:
 - More detail on how to conduct a market survey is found in a 2013 UNEP/IPEN report (See Reference 8 at end of this module.)
 - See Module F of the toolkit for paint study results in developing countries



a toxics-free future

Paint sample preparation

- Prepare work area: cover surface with clean paper/plastic; assemble needed supplies
- Wear gloves



Paint sample preparation, continued

- Apply a thin, single coating of paint to a glass or wood slide
- Use a new brush/ applicator for each sample to avoid cross-contamination
- Dry the paint in the open air or in an oven at 105 °C
- Carefully document each sample: unique sample number matched to labelling information for paint (lot number/ batch/ date)
- Ensure chain-of-custody documentation



*Photo Credit:
The EcoWaste Coalition*

Summary

- Choice of analytical method to measure lead in paint depends on many factors, such as the reason for analysis, number of samples, cost limitations, need for precise measurement, etc
- For new paint, three good laboratory methods are available that vary in cost and level of detection
- For existing painted surfaces, measurement methods include off-site laboratory analyses plus two on-site tests that vary in cost and accuracy
- Market surveys of new paints for sale are used to determine the availability of lead paint and can provide evidence to justify regulation and to monitor compliance



a toxics-free future

References

1. Environmental Lead Proficiency Analytical Testing (ELPAT) programme
<http://www.aihapat.org/ProficiencyTestingPrograms/elpat/Pages/default.aspx>
2. ASTM D3335-85a (2014), Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy, ASTM International, West Conshohocken, PA <http://www.astm.org/Standards/D3335.htm>
3. ASTM E1613-12, Standard Test Method for Determination of Lead by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES), Flame Atomic Absorption Spectrometry (FAAS), or Graphite Furnace Atomic Absorption Spectrometry (GFAAS) Techniques, ASTM International, West Conshohocken, PA
<http://www.astm.org/Standards/E1613.htm>
4. ASTM E1645-01 (2007), Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis, ASTM International, West Conshohocken, PA <http://www.astm.org/Standards/E1645.htm>
5. ASTM E1979-12, Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead, ASTM International, West Conshohocken, PA
<http://www.astm.org/Standards/E1979.htm>



a toxics-free future

References (continued)

6. ISO 1513:2010, Paints and varnishes - Examination and preparation of test samples (available in English, French and Russian).
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=50490
7. ISO 6503:1984, Paints and varnishes - Determination of Total Lead -- Flame Atomic Absorption Spectrometric Method (available in English and French)
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=12880
8. UNEP/IPEN (2013). Lead in Enamel Decorative Paint: National Paint Testing Results: A Nine Country Study (method described in pages 36-38)
http://www.unep.org/chemicalsandwaste/Portals/9/Mercury/Documents/publications/Lead_in_Enamel_decorative_paints.pdf



Additional information

Brief guide to analytical methods for measuring lead in paint (available in Chinese, English, French and Spanish)

http://www.who.int/ipcs/assessment/public_health/lead/en



a toxics-free future

Point of Contact

Dr. Sara Brosché

Global Lead Paint Elimination Project Manager

IPEN

Box 7256, SE-402 35 Gothenburg, Sweden

Email: SaraBrosche@ipen.org



a toxics-free future