



a toxics-free future

Sampling and Testing Paint

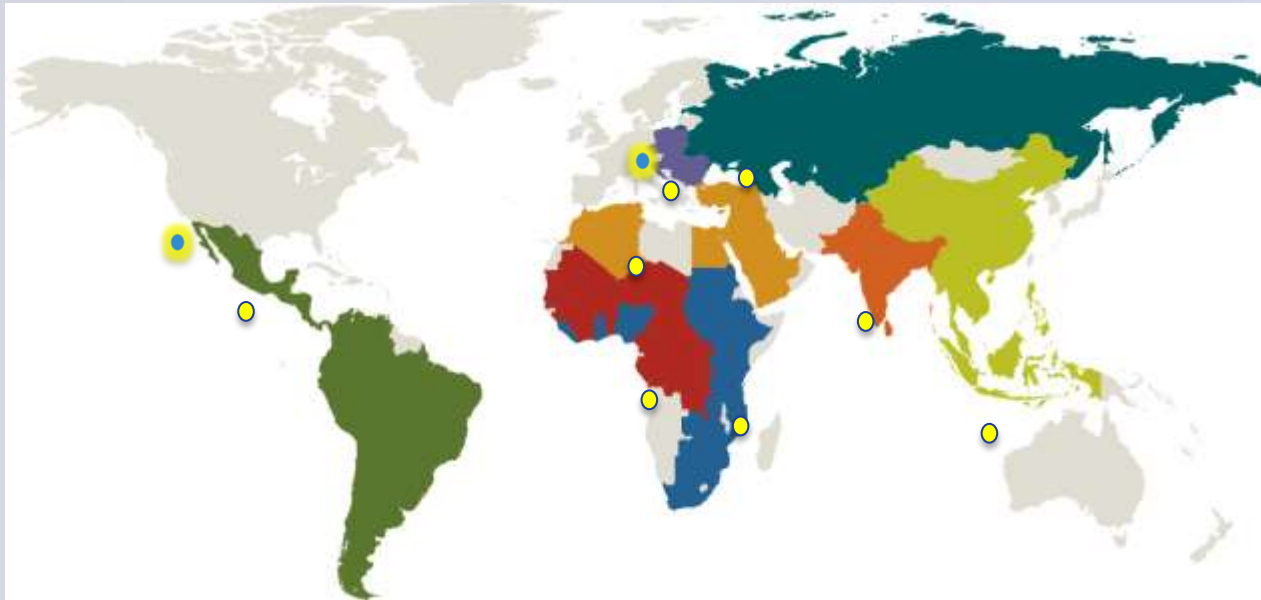
**for presentation at East Africa Sub-regional
Workshop on the Establishment of Legal Limits on Lead in Paint
(2-3 December, 2015)**

**United Nations Conference Centre
United Nations Economic Commission for Africa
Addis Ababa, Ethiopia**

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IPEN - A Global NGO Network



**700 NGOs in more than 100 Countries with a mission of
A Toxics Free Future for Everyone**

Working on POPs

Toxic Metals: Lead and Mercury

Safe Chemicals Management (SAICM)



Objectives of Presentation

- Purpose of Paint Sampling and Analysis
- How to Select Paint Samples
- Selection of Methods of Analysis
- Sample Preparation
- Interpretation and Use of Results
- Brief Mention of Lead in Old Paints (Legacy Paints).
- Presentation of Results of a Recently Completed IPEN Africa New Paint Lead Survey



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Lead Content of Legacy Paints

- Currently 23 Million Housing Units in the USA Have Lead-Based Paint Hazards as Determined by *in situ* XRF Analysis. Hazardous lead dust is formed when the painted surfaces is disturbed.
- Very Little Information Available in Other Countries on the Extent of Lead-Based Paint in Existing Housing and Other Locations Where Young Children May Be Present.



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First Part of Presentation Based Edited Version o Module C.11.

Analytical Methods for Measuring Lead in Paint

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The First Part of This Presentation

- Major Portion Adopted from Module C.11 in Tool Kit
- Additions Are In [Brackets]
- Some Deletions
- Order of Topics Altered
- Some Illustrations from OKI International

[Objectives of Paint Lead Testing]

- Assess the availability of lead paint in the market and the need for better regulation, laws and enforcement
- Provide consumers with information so that they can choose to buy non-lead paint and can push for controls on lead paint
- Draw attention to companies that produce lead paint to encourage them to reformulate their products [and to monitor progress in eliminating use of lead in making paint.]
- Assess potential sources of exposure, for example in the home, and the need for mitigation measures e.g. removal or remediation

[Approaching to Measuring Lead Content]

1. Collect a paint sample and measure its lead content in a laboratory using various analytical techniques
2. Measure the amount of lead in paint *in situ* using a portable X-ray fluorescence (XRF) device
3. Test the paint *in situ* using a chemical test kit

The choice of method depends on several factors such as the level accuracy required, the substrate to be tested (new paint or painted surface), the analytical equipment, and the cost.

[Units of Lead Content]

- The concentration of lead in paint may be expressed in a range of units e.g. ppm, %, $\mu\text{g/g}$, mg/kg , mg/cm^2
 - $90 \text{ ppm} = 0.009\% = 90 \mu\text{g/g} = 90 \text{ mg/kg}$
 - there is no equivalence between ppm and mg/cm^2 [unless thickness and density known].
 - Mg/cm^2 measures the potential amount of lead dust that can be created from a one sq cm paint chip.
- The choice of analytical method and units for reporting results is influenced by the reason for the analysis

Background

- Laboratory analysis can report the amount of lead as a proportion of the dry weight or as an amount per unit area (area concentration):
 - market surveys of new paint: preferred units are %, ppm etc as these units are relevant to paint formulation and are used in regulatory paint standards
 - For analysis of paint chips from paint already applied to housing and other areas : preferred units are often mg/cm^2 as the value is not affected by overcoats of lead-free paint
- XRF usually reports in mg/cm^2 [but ppm also possible].

Laboratory-based methods [Contd.]

- Sampling collection and preparation should be done by trained personnel to ensure samples are taken correctly
- When taking a paint chip sample from a painted surface:
 - paint must be removed from the underlying material, i.e. it is necessary to damage the painted surface
 - it is important to remove a precisely-measured area of paint [and to only remove the paint and not the substrate (wood etc.)]
- Paint must be processed, e.g. by acid digestion, before analysis
- There is usually a delay before results are available

Laboratory-based methods

- Three commonly used methods are (in order of greater to lower limit of detection):
 - Flame Atomic Absorption Spectrometry (FAAS)
 - Graphite Furnace Atomic Absorption Spectrometry (GFAAS)
 - Inductively coupled plasma atomic emission spectrometry (ICP-AES)
- Trained personnel and good quality assurance procedures are essential
- [Participation in Environmental Lead Proficiency Analytical Testing program (ELPAT) important.]

Portable X-ray fluorescence (XRF)

- [Sometimes] uses a radiation source to detect and measure lead [but an X-Ray tube is now frequently used.]
 - radiation [and X-ray] safety precautions should be followed
- Should be used by a trained operator to ensure reliable results
- Equipment is relatively expensive but is more practicable for [very rapidly]measuring a large number of surfaces ..



Portable XRF



Portable X-ray fluorescence (XRF)[Contd.]

- Tested surface does not need to be damaged
- Results are available immediately
- Good accuracy when used by a trained operator, though there may be a larger margin of error than with laboratory methods
- Can only be used on smooth, flat surfaces
- Suitable for dry paint but not wet paint

Chemical test kits

- Qualitative test for lead paint on walls or other surfaces
- Usually relies on a colour change to indicate the presence of lead above a specified concentration e.g. 5000 ppm.
- Two kinds of kit:
 - swab impregnated with reagents – wiped against painted surface and colour changes after seconds to minutes
 - test-tube with reagents into which a chip of paint is mixed



Chemical test kits [Continued]

- Only tests the exposed layer - to test underlying layers of paint need to score or scrape off the surface paint
- Special procedure may be needed for certain surfaces e.g. plaster
- Test gives rapid [qualitative] results – usually within seconds to minutes
- **Not reliable** – some kits have a high rate of false positives or false negatives

Doing a market survey of lead content in paint

- To determine available brands, [including] imported products, multi-national and national brands] and relative sales volume
- In designing the study make sure that tested products are representative of all major brands and include a range of colours
 - lead content may vary by colour
- Document information on product labels
- NB lead paint standards are based on the concentration of lead in the DRY paint



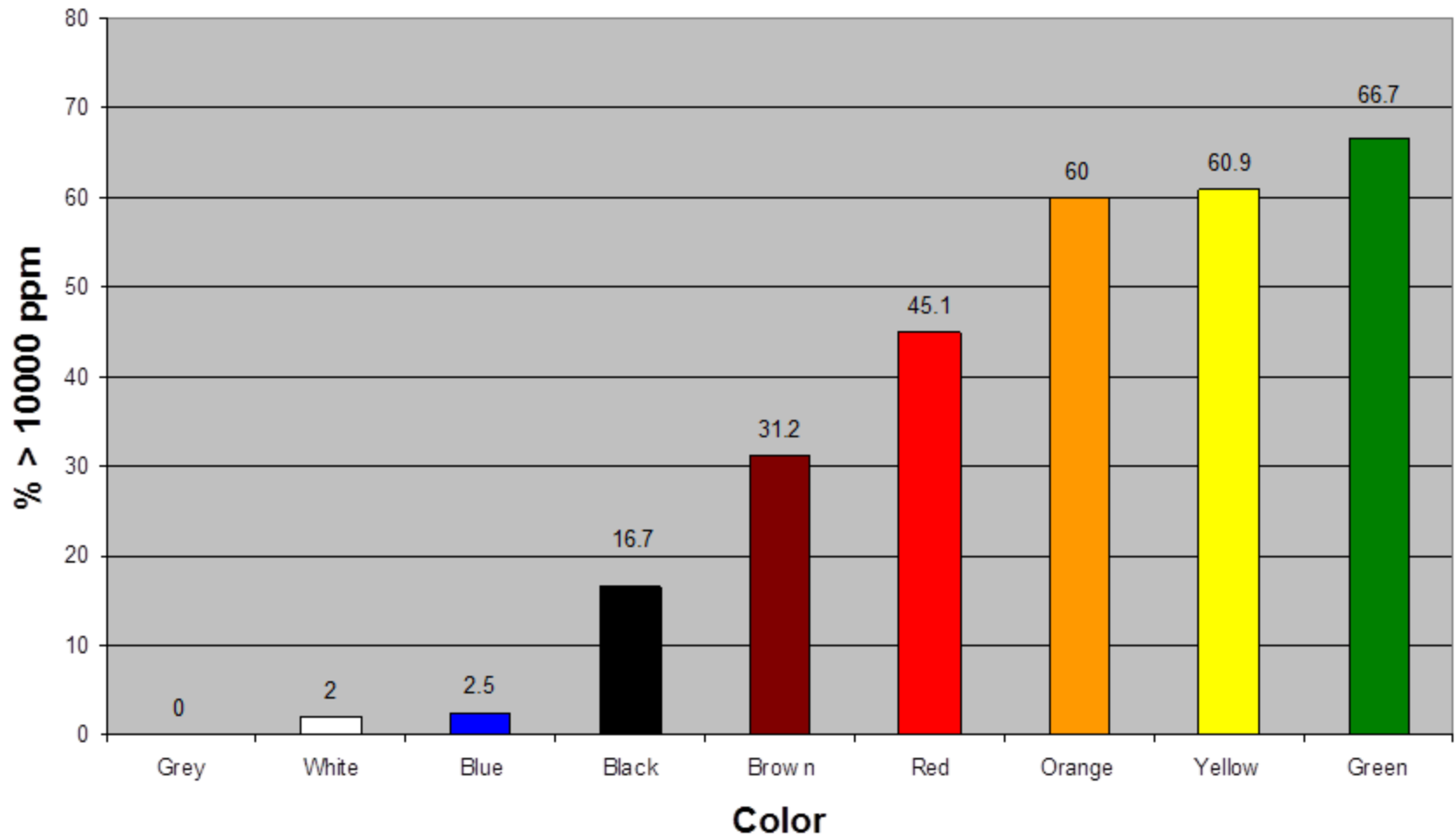
Lead Concentration Often Varies Greatly by Color (as shown in next

- Therefore Paints of Different Colors Need to be Sampled
- Yellow and Red Paints Had Higher Lead Content than White Paint as Shown in Earlier Studies.(example shown in next slide of 350 samples from ten countries)
- Since the Number of Samples that can be Purchased/Analyzed is Limited, Selecting a High-Lead Color (such as Yellow or Green) and a Low-Lead Color (such as White) is Important.



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Percentage of Samples Greater than 10000 ppm by Color



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Sample Preparation

- [Prepare work area:cover surface with clean paper/plastic; assemble needed supplies]
- Wear gloves
- Apply a thin, single coating of paint to a glass slide [,plastic] or wood
- Use a new brush/ applicator for each sample to avoid cross-contamination
- Dry the paint in an oven at 105 °C or in the open air
 - If drying in air make sure there is no danger of cross-contaminating the samples



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Paints and Sample Supplies



Preparation of Paint Samples



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Sample Preparation [Continued]

- Cover a flat work surface with [paper or]plastic to provide a clean work area
 - Wearing new gloves, use a razor blade[or other sharp device] to scrape the dried paint and place in the sample container **[This procedure is preferably done at the laboratory where possible]**
 - use a new blade for each sample
 - Carefully document each sample:
 - unique sample number matched to labelling information for paint (lot number/ batch/ date)
 - Ensure chain-of-custody documentation
- Send to laboratory for analysis



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Considerations when choosing a laboratory

- How experienced is the laboratory in paint analysis [for lead]?
- Does it participate in [ongoing] recognized proficiency testing scheme?
- What analytical methods does it use? Is the limit of detection adequate?
 - e.g. GFAAS, ICP-AES
- What are the costs per sample and the turn-around time?
- What are the shipping costs?
- Check specific sample requirements with the chosen laboratory before starting



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Laboratory qualifications

- In USA, Environmental Lead Laboratory Accreditation Program (ELLAP) accredits laboratories performing analysis of lead in environmental samples including paint
- [The Environmental Lead Proficiency Analytical Testing Program (ELPAT) was established by the US Environmental Agency to document the ongoing proficiency of environmental lead laboratories.]
- [The ELPAT] program is open to private and public laboratories worldwide
- [any other schemes worldwide?]

Existing data from African studies

Country	Study Year	Number of Paints	% Above 90 ppm	% Above 600 ppm	% Above 10,000
Cameroon	2015	54	50%	46%	17%
Côte d'Ivoire	2015	53	72%	70%	32%
Egypt	2009	20	65%	65%	
Ethiopia	2015	36	78%	78%	47%
Ghana	2013	18	33%	28%	17%
Kenya	2012	31	77%	71%	29%
Nigeria	2009	23	100%	100%	65%
Senegal	2009	21	86%	76%	19%
Seychelles	2009	28	68%	61%	
South Africa	2009	29	38%	34%	31%
Tanzania	2015	56	64%	55%	23%
Tunisia	2013	30	21%	63%	27%

Summary

- Methods for measuring the lead content in paint range from simple qualitative tests to highly accurate laboratory-based methods
- The choice of method depends on needs e.g. number of samples, cost limitations, need for precise measurement
- Market surveys to determine the availability of lead paint in a country require careful planning, documentation and laboratory selection

References

Based on a presentation given at the Global Alliance to Eliminate Lead Paint Workshop on Establishing Legal Limits on Lead in Paint, 22 – 23 September 2014, New Delhi, India

Adapted for inclusion in the Lead Paint Alliance “Toolbox” for Governments, April 2015

Photo credits for lead paint sampling: Perry Gottesfeld, ©2014, Occupational Knowledge International

Ciii1. 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/

Ciii2. US Consumer Product Safety Commission, Test Method: CPSC-CH-E1003-09.1 Standard Operating Procedure for Determining Lead (Pb) in Paint and Other Similar Surface Coatings
<http://www.cpsc.gov/PageFiles/128129/CPSC-CH-E1003-09.pdf>



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Ciii3. Environmental Lead Laboratory Accreditation Program (ELLAP)

<http://www.aihaaccreditedlabs.org/programs/Pages/ELLAP.aspx>

Ciii4. US HUD Guidelines for the evaluation and control of lead-based paint hazards in housing (2012)

http://portal.hud.gov/hudportal/documents/huddoc?id=second_edition_2012.pdf