Analytical methods for measuring lead in new paint

Elena Jardan
Consultant
World Health Organization

19 November 2020
Outline

• Objectives of lead paint testing
• Overview of sample methods
• Overview of test methods: laboratory and portable methods
• Considerations when choosing a laboratory
• Quality considerations
• Considerations for building laboratory capacity
Objectives of Lead Paint Testing

• To determine if paint meets the regulatory requirement for permitted lead content
• Paint manufacturers and importers – to obtain documentation of compliance with lead paint limit
  ➢ Third-party laboratory testing: use a nationally or internationally accredited laboratory that can measure the lead content to the required limit (e.g. 90 ppm) to support a Declaration of Conformity
• Government – testing for compliance with lead paint limit
  ➢ Use a nationally or internationally accredited laboratory or suitable portable analysis technology to test for compliance with regulatory limit
Sampling Methods

• Most common method is to apply paint to a homogeneous metal-free surface such as glass or wood

• Paint is allowed to dry then a sample is scraped off for analysis in a laboratory

• Lead content may also be measured directly from surface using portable high definition x-ray fluorescence and reported in ppm

• Possible to measure lead in sample of wet paint using special sampling cup and high definition x-ray fluorescence
Two testing options

• **Laboratory analysis (various methods)** — samples are collected and sent to a laboratory
  ➢ results are reported after a period of time

• **Portable analysis using high-definition X-ray fluorescence (HDXRF)** — analysis can be done outside a laboratory e.g. at customs
  ➢ results are available immediately
Three commonly used laboratory methods for lead paint

Methods

• Flame atomic absorption spectrometry (FAAS)
• Electrothermal or graphite furnace atomic absorption spectrometry (ETAAS/GFAAS)
• Inductively-coupled plasma atomic emission spectrometry (ICP-AES)

Considerations

• Methods differ in complexity, limit of detection and cost
• International standards exist for each
Considerations when choosing a laboratory

• Laboratory's experience and capacity in lead paint analysis

• If possible, accreditation through a recognized proficiency testing scheme

• Analytical methods used (e.g. FAAS, GFAAS/ETAAS, ICP-AES)
  ➢ limit of detection – is it adequate to confirm compliance?

• Sample requirements specified by laboratory

• Costs per sample, including any shipping costs

• Turn-around time
Laboratory should demonstrate compliance with quality standards

- Trained personnel and good quality assurance procedures are essential to ensure accuracy and reliability of results.

- Laboratory should have certification to show it works to an international standard e.g., ISO/IEC 17025.

- Laboratory should comply with national or international standards for sample preparation and analysis for lead in paint.

- Laboratory should be accredited to conduct analyses by a national or international accreditation program.
Environmental Lead Proficiency Analytical Testing (ELPAT) Program

- Operated by American Industrial Health Association

- ELPAT program assesses proficiency of laboratory in lead analysis of environmental samples, including for paint

- Laboratories shown to be proficient conduct lead paint testing to international standards

- Mostly in the US; non-US laboratories currently in Australia (2), Canada (6), France (1), Germany (1), Japan (2), Korea (1)

- Laboratories may work with clients in any country

- Link: https://www.aihapat.org/programs/environmental-lead-proficiency-analytical-testing-elpat-program
High-Definition XRF (HDXRF)

- Relatively new technology using optics to enable measurement of very low concentrations of lead
- Comparable results to laboratory methods and suitable for compliance testing of new paints
- approved as alternative to laboratory methods in the USA – ASTM F2853-10
- Paint sample on metal-free homogeneous surface placed in front of device – lead concentration shown on screen within minutes
- Portable and bench-top models available
- Expensive to buy but cheaper to operate than conventional laboratory methods
- Uses ionizing radiation so specific health-and-safety and training needs
The Question of Laboratory Capacity

- UNEP *Model Law and Guidance for Regulating Lead Paint* suggests:

  “Current lack of in-country laboratory capacity need not be an impediment to a lead paint law going into effect, as industry can still comply with the law by sending paint samples to laboratories in other countries that are qualified to perform the required testing. Additionally, for imported paints, manufacturers and importers can rely on test results from qualified laboratories in the country of origin under the model law under certain circumstances.”
Increasing demand for laboratory testing creates a market

- Regulations specifying a low limit on lead content of paint create a demand for laboratories to carry out compliance testing

- A laboratory can provide a service to manufacturers and regulatory authorities in multiple countries

- Establishing a laboratory service requires significant resources, therefore business case must be made

- May be possible to expand an existing laboratory service
Considerations for building laboratory capacity

• Can lead paint analysis be added to an existing service, e.g.
  ➢ is the necessary equipment already available (e.g. GFAAS)?
  ➢ what additional equipment (e.g. lamps), reagents and training are needed?
  ➢ is there a sufficient demand for the service to be sustainable (e.g. offering third-party testing to manufacturers, compliance testing for regulators)
• Is the service already available in a laboratory at home or abroad at a good price
• Large paint manufacturers have lab capacity and trained personnel that can be utilized to supplement testing by accredited labs
Conclusions

• Lead paint testing is a key enforcement and compliance tool in the Lead Paint Model Law

• Regulations drive development of lead paint test methods, technologies and laboratory networks

• Analytical methods include laboratory methods and portable methods that vary in cost and resource needs

• International standards exist for laboratory competency, sampling and testing
Available WHO resources

Brief guide to analytical methods for measuring lead in paint

https://www.who.int/publications/i/item/9789240006058
Thank you!

Elena Jardan
jardane@who.int
Consultant
World Health Organization
Appendix

Units for reporting lead content in new paint

• Regulatory limits for total lead concentration may be expressed as parts per million (ppm), percent (%) or mg/kg

• 90 ppm = 0.009% = 90 mg/kg

• Laboratory methods can report in any of the above units

• Lead content on a painted surface may also be reported in mg/cm² but this is not appropriate for compliance assessment for lead in new paint
  ➢ not a mass concentration measurement
  ➢ cannot reliably be converted to mass concentration measurement