Africa Webinar on Standard Methods for Testing Lead in Paint

21 September 2022

Start: 7:30 am EDT/ 1:30 pm Central Africa Time or GMT+2

End: 10:30 am EDT/ 4:30 pm Central Africa Time or GMT+2

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Welcome!

Introduction to the Zoom platform and Meeting Procedures

- **Moderator:** Jennifer Tursi
- **Interpreters:** Ms. Beatrice Beer and Ms. Helena Solodky-Wang
- Please remember to mute your microphone to avoid unwanted noise.
- Utilize the interpretation button/ function and choose the preferred language.

- If you have questions during the presentation, please utilize the chat box.
- Segmented time is also allocated after each category.
- Additional resources and contact information will be provided at the end of the presentation and distributed.
Opening Remarks and Overview

Deputy Director, and Regional Representative of the United Nations Environment Programme (UNEP) Regional Africa Office

– **Speaker:** Richard Munang
Opening Remarks and Overview

ASTM International MOU Program

- **Speaker:** Maria Jiverage
- **Objectives of the Webinar:**
  - The importance of internationally accepted standards and the role of standards bodies.
  - Overview of the lifecycle of the sampling process:
    - How to select a laboratory
    - Best Practices
    - Determining Proper Methods
  - Provide technical information on sample preparation and testing methods for lead in new paint.
  - Aid countries to develop; or implement a lead paint law to understand which sample preparation and test methods are appropriate for their situation.
  - Opportunity to engage and ask questions of technical experts about specific methods.
  - Provide country case studies about the use of test methods.
Opening Remarks and Overview

World Health Organization (WHO)

Speaker: Elena Jardan

Overview of Brief Guide to Analytical Methods for Measuring Lead in Paint in developing or implementing lead paint laws.

Outline:
- Role of testing in the Model Law and Guidance for Regulating Lead Paint
- Objectives/reasoning of lead paint testing
- Options for measuring lead paint – new and existing paint
- Issues around national laboratory capacity for measuring lead in paint
- Summary
Role of Testing in the Model Law and Guidance for Regulating Lead Paint

World Health Organization (WHO)

Speaker: Elena Jardan

- The UNEP Model Law and Guidance for Regulating Lead Paint or Model Law is a template for drafting strong lead paint laws (see also Module C-2. for more information) and lists many of the standards we will be discussing today.

- In the Model Law, testing of paint plays a central role in documenting industry compliance in meeting a low legal limit on lead in paint (90 ppm)

- Industry is responsible for testing: Manufacturers and importers arrange for testing of their paints and certify compliance with lead limit
  - Use of third-party accredited labs
  - Use of recommended international sample preparation and test methods

- Government is responsible for enforcement: Inspectors can test paints as one way to check for compliance
Objectives of lead paint testing

World Health Organization (WHO)

Speaker: Elena Jardan

- 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** – to test 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
Reason for analyzing the lead content of paint

World Health Organization (WHO)

Speaker: Elena Jardan

- **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 of lead paint
  - Draw attention to companies that produce lead containing paint and encourage them to reformulate their products voluntarily

- **Existing paint on structures**
  - Assess potential source of exposure to lead from existing paint on structures, e.g. in homes, schools, and playgrounds, and the possible need for mitigation measures
Options for measuring lead in paint

World Health Organization (WHO)

Speaker: Elena Jardan

New paint for sale:
1. Laboratory analysis
   - Flame atomic absorption spectrometric method (FAAS),
   - Graphite Furnace Atomic Absorption Spectrometry (GFAAS),
   - Electro thermal atomic absorption (ETAAS), or
   - Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)
2. High-definition portable X-ray fluorescence analysis (HDXRF)

Existing painted surface:
1. Laboratory analysis
2. Portable X-ray fluorescence (XRF) analysis (on-site)
3. Chemical test kits (on-site)

The choice of method depends on several factors e.g., the level of accuracy required, the substrate to be tested (new paint or painted surface), the analytical equipment, and the cost.
Methods Cited in the WHO Guidance

World Health Organization (WHO)

Speaker: Elena Jardan

International Standards for Sample Collection
- ASTM E1729- Standard practice for field collection of dried paint samples for subsequent lead determination
- ISO 15528:2013- Paints, varnishes and raw materials for paints and varnishes – sampling (available in English, French and Russian)

International Standards for Preparation
- ISO 1513:2010 - Paints and varnishes - examination and preparation of test samples
- ASTM E1645- Standard practice for preparation of dried paint samples by hotplate or microwave digestion for subsequent lead analysis
- ASTM E1979 - Standard practice for ultrasonic extraction of paint, dust, soil, and air samples for subsequent determination of lead

International Standards for Test Methods
- ISO 6503:1984, Paints and varnishes - Determination of total lead - FAAS (for measurement of lead concentration of 0.01% to 2.0%) (available in English and French)
- ASTM D3335 - 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 - Standard Test Method for Determination of Lead by ICP-AES, FAAS, or GFAAS Techniques (measurement of lead concentration differs according to analytical technique)
- ASTM F2853- Standard test method for determination of lead in paint layers and similar coatings or in substrates and homogenous materials by energy-dispersive X-ray fluorescence spectrometry using multiple monochromatic excitation beams
Laboratory Should Demonstrate Compliance with Quality Standards

World Health Organization (WHO)

**Speaker:** Elena Jardan

- 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
Is In-Country Laboratory Capacity Essential for Compliance?

World Health Organization (WHO)

**Speaker:** Elena Jardan

*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

World Health Organization (WHO)

Speaker: Elena Jardan

- 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
World Health Organization (WHO)

Speaker: Elena Jardan

- Lead paint testing is a necessary part of enforcement and compliance activities of regulations to drive elimination of lead paint.
- 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, there are good laboratory methods are available that vary in cost and limit of detection.
- For existing painted surfaces, reliable measurement methods are off-site laboratory analysis or on-site, portable XRF (costs and limit of detection vary).
- International standards exist for laboratory competency, sampling and testing.
- Market surveys of new paints for sale are used to determine the presence of lead paint and can provide evidence to justify regulation and to monitor compliance.
- Brief Guide to Analytical Methods for Measuring Lead in Paint: https://www.who.int/publications/i/item/9789240006058
Sampling and Sample Preparation Methods

• Overview of Paint Sampling Methods in the Field
• Overview of ASTM International and ISO Standards for Sample Preparation and Methodologies
• Country Case Study
• Q & A
Overview of Paint Sampling Methods in the Field

International Pollutants Elimination Network (IPEN)

Speaker: Jeiel Guarino

- Overview of IPEN’s Sampling and Sample Preparation Methods in the Field
  - Paint market analysis and paint brand survey
  - Paint purchase
  - Sample preparation and shipping to the lab
Paint Market Analysis and Paint Brand Survey

International Pollutants Elimination Network (IPEN)

Speaker: Jeiel Guarino

– Market analysis entails research on the national paint market using publicly available information accessible through, e.g., web searches, online media, public reports, etc.

– Paint brand survey involves online research and personal visits to stores selling paints to assess which brands sell paints for household or consumer use.

– Information gathered during the paint brand survey will be used to assess which paints will be purchased for lead content analysis.
Paint Purchase
Purchase of paints is dependent on the type and color of paints with the potential for high lead content.

<table>
<thead>
<tr>
<th>Type of Paint</th>
<th>Color of Paint</th>
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</thead>
<tbody>
<tr>
<td>Solvent-based paint</td>
<td>Yellow</td>
</tr>
<tr>
<td>Oil-based paint</td>
<td>Red</td>
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<tr>
<td>Alkyd paint</td>
<td>Orange</td>
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<tr>
<td>Enamel paint</td>
<td>Green</td>
</tr>
<tr>
<td>Primer/Anticorrosive paint</td>
<td>Others (white, pink, grey, brown, black, blue)</td>
</tr>
<tr>
<td>Aerosol/spray paint</td>
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</tbody>
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Sample Preparation and Shipping to the Lab
Sample Preparation & Shipping to the Lab

International Pollutants Elimination Network (IPEN)

Speaker: Jeiel Guarino

- Information such as color, brand, manufacturer, country of manufacture, product codes, production dates, and other details as provided on the label of the paint can is recorded.

- Each can of paint is pre-labeled and thoroughly stirred, and samples of paint (at least 2 grams) are applied onto wooden sticks/glass slides using a paintbrush.

- Triplicate/duplicate samples are prepared for each paint.

- Each stirring utensil and paintbrush are used only for the same paint to avoid cross contamination among samples.

- All samples are allowed to dry at room temperature within 3-5 days.

- Once dried, samples are placed inside resealable plastic bags and shipped to the lab for lead content analysis.
ASTM Committee D22 and D01

**ASTM International**

**Speakers:** Kenn White and Andrew Burris

**ASTM Subcommittee D22.12 on Sampling and Analysis of Lead for Exposure and Risk Assessment**
(part of ASTM Committee D22 on Air Quality)

**ASTM Subcommittee D01.21 on Chemical Analysis of Paints and Paint Materials**
(part of ASTM Committee D01 on Paint and Related Coatings, Materials, and Applications)

- **Process**
  - Recognize or be advised of a need
  - Convene a Task Group of Stakeholders
  - Bring in more Experts (ASTM Members and Non-members)
  - Draft a Standard and Ballot to a subcommittee (ex: D22.12 or D01.21)
  - Review and Revise as Needed, and Re-ballot D22.12 if necessary (repeat as necessary to reach consensus)
  - Main Ballot to (ex: D22 or D01)
  - Review and Revise as Needed and Re-ballot if necessary (repeat as necessary to reach consensus)
  - Publish the New Standard
  - At least every 5 years or as changes/updates are needed, repeat the process in review

- **D22.12 has 29 active/current standards**
- **D01.21 has 37 active/ current standards**
Overview of ASTM Standards for Sample Preparation and Methodologies

**ASTM International**

**Speaker:** Kenn White

**E1729: Standard Practice for Field Collection of Dried Paint Samples for Subsequent Lead Determination**

- **Scope:** This practice covers the collection of samples of dried paint and other coatings from buildings.

- **Summary:** Samples are collected for subsequent determination of lead on an area basis (milligrams of lead per area sampled) or concentration basis (milligrams of lead per gram of dried paint collected or mass percent of lead in the paint sample collected).

- **Significance & Use:** Although this practice is intended for the collection of dried paint samples in and around buildings for the subsequent determination of lead content, this practice may also be used to collect paint samples from other structures for lead analysis.

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Overview of ASTM Standards for Sample Preparation and Methodologies

Speaker: Kenn White

E1728/E1728M: Standard Practice for Collection of Settled Dust Samples Using Wipe Sampling Methods for Subsequent Lead Determination

- **Scope:** This practice covers the collection of settled lead-containing dust on surfaces using the wipe sampling method. These samples are collected in a manner that will permit subsequent extraction and determination of lead using laboratory analysis techniques such as atomic spectrometry or electroanalysis.

- **Significance & Use:** This practice is intended for the collection of settled dust samples in and around buildings and related structures for the subsequent determination of lead content. The practice is meant for use in the collection of settled dust samples that are of interest in clearance, hazard assessment, risk assessment, and other purposes.
E1727: Standard Practice for Field Collection of Soil Samples for Subsequent Lead Determination

- **Scope:** This practice covers the collection of bare soil samples from areas around buildings and related structures using coring and scooping methods.
- **Summary:** This practice limits soil collection to approximately the top 1.5 cm (0.6 in.) of soil surface.
- **Significance & Use:** This practice is intended for the collection of soil samples from bare areas in and around buildings, this practice may also be used to collect soil samples from other areas and environments.
WK82689 – New Standard Practice for Field Collection of Airborne Dust Samples for Subsequent Lead Determination

- **Scope:** This practice covers the collection of personal airborne particulate samples during activities involving lead. It may also be used for collection of area airborne particulate samples.
- **Summary:** This practice is used to collect samples for subsequent determination of lead on a mass per volume basis (milligrams of lead per cubic meter of air sampled).
E1645 Standard Practice for Preparation of Dried Paint Samples by Hotplate or Microwave Digestion for Subsequent Lead Analysis

- **Scope:** This practice covers the sample preparation procedures for paint samples that are collected during the assessment, management or control of lead hazards.

- **Summary:** Lead in dried paint samples (chips, powder, and so forth) is solubilized (extracted) by digestion with nitric acid and hydrogen peroxide facilitated by heat, or by a mixture of nitric acid and hydrochloric acid facilitated by microwave energy.
Overview of ASTM Standards for Sample Preparation and Methodologies

ASTM International

Speaker: Kenn White

E1644 Standard Practice for Hot Plate Digestion of Dust Wipe Samples for the Determination of Lead

- **Scope:** This practice covers the acid digestion of surface dust samples (collected using wipe sampling practices) and associated quality control (QC) samples for the determination of lead.

- **Summary:** A dust wipe sample is digested using hot plate type heating with nitric acid and hydrogen peroxide. The digestate is diluted to final volume prior to lead measurement.
Overview of ASTM Standards for Sample Preparation and Methodologies

ASTM International

Speaker: Kenn White

E1726 Standard Practice for Preparation of Soil Samples by Hotplate Digestion for Subsequent Lead Analysis

- **Scope:** This practice covers drying, homogenization, and acid digestion of soil samples and associated quality control (QC) samples using a hot plate type method for the determination of lead.

- **Summary:** A representative soil sample is dried and homogenized, and then digested (in a batch mode with other samples) on a hot plate using nitric acid and hydrogen peroxide. The digestate is diluted for final volume prior to lead measurement.
Overview of ASTM Standards for Sample Preparation and Methodologies

ASTM International

Speaker: Kenn White

E1979 Standard Practice for Ultrasonic Extraction of Paint, Dust, Soil, and Air Samples for Subsequent Determination of Lead

- **Scope:** This practice covers an ultrasonic extraction procedure for the extraction of lead from environmental samples of interest in lead abatement and renovation (or related) work, for analytical purposes. Environmental matrices of concern include dry paint films, settled dusts, soils, and air particulates.

- **Significance & Use:** Ultrasonic extraction using dilute nitric acid is a simpler and easier method for extracting lead from environmental samples than are traditional digestion methods that employ hot plate or microwave digestion with concentrated acids. Hence, ultrasonic extraction may be used in lieu of the more rigorous strong acid/high temperature digestion methods, provided that the performance is demonstrated using accepted criteria.
Overview of ISO Standards for Sample Preparation and Methodologies

Matthew Sica Consulting representing ANSI National Accreditation Board

Speaker: Matthew Sica

ISO/IEC 17025 Testing and Calibration Laboratories

– **Scope:** Accreditation and Conformity Assessment

– **Requirements:** Structural, Resource, Process, Management System

– **Significance & Use:** Independent Assessment of Competence
ISO/IEC 17025: Who Benefits from Accredited Conformity Assessments?

Matthew Sica Consulting representing ANSI National Accreditation Board

Consumers
- Basis for selecting products
- Added confidence in products purchased

Manufacturers
- Ensure products meet specifications and requirements
- Avoid cost of product failures and recalls

Regulators
- Means to enforce national health, safety, and environmental legislation
- Achieve public policy goals
ISO/IEC 17025: Risk Management

Matthew Sica Consulting representing ANSI National Accreditation Board

Internal context (within the management system)

- Processes (operations)
- People
- Products and services used by the lab
- Equipment

External context (based on management system outcomes)

- Reporting/nonconforming work/customer service
  - Reputation
  - Confidence
  - Financial
ISO/IEC 17025: Accreditation

Matthew Sica Consulting representing ANSI National Accreditation Board

Independent assessment against recognized standards to ensure impartiality and competence

Provides assurance to customers and industry that accredited laboratory continues to operate according to internationally accepted criteria
Accreditation of the conformity assessment body (laboratory)

- Demonstrates competence
- Reduces risk
- Promotes consistency
- Promotes confidence in products and services provided

Matthew Sica Consulting representing ANSI National Accreditation Board
ISO/IEC 17025: Accreditation Process

Matthew Sica Consulting representing ANSI National Accreditation Board

- How does a lab start the process of getting accredited?
  - Purchase standard
  - Take standard training, if needed
  - Develop processes/documents

- How long goes it take?
  - Nine months to a year and a half
  - Many factors involved
ISO/IEC 17025: Accreditation Process

Matthew Sica Consulting representing ANSI National Accreditation Board

- What steps are involved?
  - Laboratory Control
    - Laboratory prepares Management system
    - Participate in PTs
    - Conduct Internal Audit and Management Review
  - AB Process
    - Application
    - Document review
    - Accreditation Assessment
    - Corrective Action (if required)
    - Accreditation Package Review
    - Accreditation Decision
Accreditation is all about CONFIDENCE in the organization’s TECHNICAL COMPETENCE
Overview of ISO Standards for Sample Preparation and Methodologies

South African Bureau of Standards

Speaker: Abe Msibi

1513 Paints and Varnishes- Examination and preparation of test samples

- **Scope:** This standard specifies the procedure for examination of a sample intended for testing. It also specifies the acceptance of a rejection criteria of the sample to be tested.

- **Requirements:** The sample shall be free from defects that cannot be re-incorporated effectively.

- **Procedures:** The sample is examined visually and with spatula to detect any undesired defects.

- **Significance & Use:** Examination of sample before analyses will eliminate error probability and ensure validity of results.
Country Case Study

Environmental Protection Agency Sierra Leone (EPA-SL)

Speaker: Mohamed Abdulai Kamara

Reason for Sampling and Testing:
- To serve as a baseline study prior to validating the lead paint regulations – called for in multi-stakeholder consultation.
  - for compliance and enforcement
  - for research, and
  - to set standard limits
- Market study – review local and imported brands of paint.
- We collaborated with the iNGO Lead Exposure Elimination Project (LEEP) on the study
- Different brands were bought from the market and samples were prepared.
  - Used red, yellow, and white (or similar colors if not available).
  - Tested 31 samples total from 8 different brands: 22 oil based and 9 water based.
Country Case Study

Environmental Protection Agency Sierra Leone (EPA-SL)

Speaker: Mohamed Abdulai Kamara

What standard methods use and why:

We prepared dry samples and sent them to an international private lab:

- Put thin layer of wet paint on plastic porcelain
- Use clean gloves and clean stirrers to avoid cross-contamination
- Leave to dry for about one week, before putting in individual plastic bags and mail to lab
- Lab uses NIOSH 7303: paint chips were digested using hydrochloric acid, nitric acid and a hot block. The samples were analysed using Inductively Coupled argon Plasma-Atomic Emission Spectrometry (ICP-AES)
- Lab is fully accredited; ensures high quality of results of baseline study. Reporting limit is 60ppm so high assurance on accuracy for 90ppm limit
Country Case Study

Environmental Protection Agency Sierra Leone (EPA-SL)

Speaker: Mohamed Abdulai Kamara

Results

- Results showed that 47% of the solvent-based paint samples for home use contained >90 ppm lead
- Three of the seven brands tested contained >90 ppm lead
- The highest lead content detected was 32,000 ppm.

Lessons Learned

- It is possible to conduct a study testing paint for lead with simple equipment by sending to an international lab
- Lab fees were $513 in total to test 19 samples of solvent-based paint
- National labs can also be equipped for lead testing
- Results sharing via stakeholder meetings and engagement with local manufacturers
Country Case Study

Environmental Protection Agency Sierra Leone (EPA-SL)

Speaker: Mohamed Abdulai Kamara

Conclusions:
- This study clearly motivates lead paint regulation to safeguard the people of Sierra Leone
- Partnership between government agency and iNGO is a possible route for testing
- Strengthening local testing capacity is a challenge to address
Questions and Answers

ASTM International

- **Duration:** Ten Minutes

- Please feel free to utilize the chat and raise hand feature, located at the bottom of the tool bar:

  ![Chat and Raise Hand Features](image-url)
Break (Ten minutes)
Laboratory Analysis

- Overview of ASTM International and ISO Standards for Lab Analysis
- Country Case Study
- Q & A
Overview of ASTM Standards for Lab Analysis

ASTM International

– **Speaker**: Andrew Burris

– **D3335 Standard Test Method for Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy**

– **Scope**: Determination of lead\(^2\) between 0.01 and 5% [100 ppm–50,000 ppm] in liquid coatings or dried films

– Only pigmented coatings evaluated; should work for varnishes and lacquers

– Not applicable to lead in samples containing antimony pigments—low recovery

– Organic lead > 0.1% (1,000 ppm): small losses / slightly poorer precision

– 100 ppm–50,000 ppm analytical range not absolute; can go lower/higher

– MDL/MRL must be determined experimentally (e.g., EPA “Definition and Procedure for the Determination of the Method Detection Limit, Revision 2”)

– Laboratories can achieve 25 ppm MDL / 50 ppm MRL

Overview of ASTM Standards for Lab Analysis

ASTM International

Speaker: Kenn White

E3193 Standard Test Method for Measurement of Lead (Pb) in Dust by Wipe, Paint, and Soil by Flame Atomic Absorption Spectrophotometry (FAAS)

- **Scope:** The test method covers the determination of lead (Pb) in dust by wipe, paint, and soil collected in and around buildings and related structures by flame atomic absorption spectrophotometry (FAAS). For determination of lead (Pb) and other metals in air by FAAS, see Test Method D4195.

- **Expected Detection Limit:** 0.02 μg/mL (approximately three times standard deviation of blank) with an Optimum Linear Range Upper Limit of 10 μg/mL
Overview of ASTM Standards for Lab Analysis

ASTM International

Speaker: Kenn White


– **Scope:** This test method specifies a procedure for analysis of dried paint, soil, and dust wipe samples collected in and around buildings and related structures for lead content using inductively coupled plasma-optical emission spectroscopy (ICP-OES).

– Method detection limits (MDLs) and method quantitation limits (MQLs) depend on a number of factors, including the sample matrix (including sampling media), the sample preparation method, the analytical wavelength selected, the analytical instrument used, the instrument operating parameters, and blank variability.
Overview of ASTM Standards for Lab Analysis

ASTM International

Speaker: Kenn White

D6785 Standard Test Method for Determination of Lead in Workplace Air Using Flame or Graphite Furnace Atomic Absorption Spectrometry

− **Scope:** This standard specifies flame and graphite furnace atomic absorption spectrometric methods for the determination of the time-weighted average mass concentration of particulate lead and lead compounds in workplace air.

− The flame atomic absorption method is applicable to the determination of masses of approximately 1 to 200 μg of lead per sample, without dilution. The graphite furnace atomic absorption method is applicable to the determination of masses of approximately 0.01 to 0.5 μg of lead per sample, without dilution.

− This standard has been published in order to make available a method for making valid exposure measurements for lead.
Overview of ASTM Standards for Lab Analysis

ASTM International

Speaker: Kenn White

E1613 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

- **Scope:** The method covers the lead analysis of sample extracts or digestates (for example, extracted or digested paint, soil, dust, and airborne particulate) using inductively coupled plasma atomic emissions spectrometry (ICP-AES), flame atomic absorption spectrometry (FAAS), or graphite furnace atomic absorption spectrometry (GFAAS).

- Withdrawn 2021; consider ISO 19025 requirements

- **Scope**: This practice covers the qualifications, including minimum requirements for personnel and equipment, duties, responsibilities, and services of laboratories engaged in the determination of lead in paint, or settled dust, or airborne particulates, or soil, or any combination thereof, taken from and around buildings and related structures.

- This practice has been developed consistent with Guides E548 and E994, to supplement ISO/IEC 17025.
E1583 Standard Practice for Evaluating Laboratories Engaged in Determination of Lead in Paint, Dust, Airborne Particulates, and Soil Taken From and Around Buildings and Related Structures (continued)

- **Significance & Use:** This practice provides the basic criteria to be used by accreditation bodies and others in evaluating the qualifications of laboratories engaged in the testing of lead in paint, or settled dust, or airborne particulates, or soil, or combination thereof, taken from and around buildings and related structures.
- This practice is also intended for use by laboratories in the development and implementation of their management systems and for use to request or perform an evaluation of in-house facilities in accordance with this practice.
Overview of ISO Standard for Lab Analysis

South African Bureau of Standards

Speaker: Abe Msibi

6503 Paints and varnishes - Determination of total lead - Flame atomic absorption spectrometric method

- **Scope:** This standard specifies the apparatus, reagents and the procedure of converting paints and varnishes into liquids that can be introduced to a flame atomic absorption spectrometry for determination of Lead. It describes the dry ashing and wet oxidation as methods that can be used for test portion preparation. It is applicable to determine mass % of lead content within a range of about 0.01 to 2% in a product.

- **Requirements:**
  - The sample to be used shall comply with the requirements of ISO 1513
  - Reagents of recognized analytical grade shall be used
  - Water of at least grade 3 purity shall be used
Overview of ISO Standard for Lab Analysis

South African Bureau of Standards

Speaker: Abe Msibi

- 6503 Paints and varnishes- Determination of total lead- Flame atomic absorption spectrometric method

- Procedures:
  – Reagents preparation
  – Test portion decomposition
  – Extraction of lead
  – Standard solution preparation
  – Perform analyses
  – Calibration graph
  – Determination

- **Significance & Use:** The standard is useful for quantification of small percentage of lead.
Country Case Study

**Centrales**

**Speaker:** Patrick Vivian Ngoambe

**Reason for Testing:**
- In Cameroon, the Cameroonian Minister of the Environment, Nature Protection and Sustainable Development (MINEPDED) had signed on September 21, 2017 "Order 004/MINEPED/CAB of September 21, 2017 modifying and supplementing the list of substances chemicals of Decree No. 2011/2581/PM of 23 August 2011 regulating harmful and/or dangerous chemical substances. In order to frame regulations on the protection of the environment and preservation of the health of populations on the harmful effects of lead in Product.

**Standard:**
- The STANDARDS AND QUALITY AGENCY (ANOR) of CAMEROON was created by Presidential Decree No. 2009/296 of September 17, 2009 on the creation, organization and functioning of the Standards and Quality Agency (ANOR).
- It is with a view of providing Cameroon with national standards that ANOR has embarked on a vast product standardization program by setting up Technical Committees for each sector of activity and with regard to the determination of the total lead in paints and similar products, no national standard has been adopted in Cameroon to date, which is why paint manufacturers operating in Cameroon are obliged to comply with the requirements of the American standard and ISO standards, namely ISO EN ISO 1513.

**Research:**
- As part of our research on lead paints we have consulted the Brief Guide to Methods of Determining Lead in Paint Second Edition produced by the World Health Organization 2020
Market research:

- Before any collection of paint samples material occurred, traceability sheets were developed, tested and used to collect information on paint brands, types of paints, batches, volumes, labeling, and materials for packaging.

- The data was collected on a total of 17,740 cans of paint used during the painting of certain structures as part of the SONARA EVOLUTION OF THE EPC REFINING SCHEME PHASE 1 project, delivered by the various suppliers. During our field study conducted in a total of 76 retail and wholesale suppliers of residential and industrial paints in Cameroon. 17,740 cans in our inventory represented approximately 300 different paint products, many repeating themselves in several hardware stores visited. 45% of the valid products listed turned out to be oil-based paints, 38% water-based paints, and 17% other (synthetic products). The paints came from 52 different manufacturers, including 20 local manufacturers and 32 foreign manufacturers. Based on our inventory, the manufacturers with the most products present in hardware stores are La Seigneurie/CEP, Smalto, Universal and National Paint (from the United Arab Emirates).

- Our survey revealed that the paints marketed in Cameroon come from all continents, but that local manufacturers dominate. We were unable to rigorously determine the market share indicating the sales volume for each specific manufacturer or for the country in general.

- The market survey has also been an important resource for gathering information on current practices in ingredient and hazard labeling, and other health and environmental information. Only 14% of the 17,740 cans of paint inventoried had labels with information on the chemical composition on the packaging. Our analysis leads to the conclusion that there is a lack of information provided to the consumer; which could help increase exposure among painters and the general public.

- We also found that most of the paints sold on the Cameroonian market are not accompanied by product documentation: lack of product conformity certificate issued by the manufacturer; non availability of technical sheets and safety data sheets on delivery of the product to allow the user to have information on the chemical composition of the paint and the dangers of the product.
Country Case Study

Centrales
Speaker: Patrick Vivian Ngoambe

Method Used:
- The chose method was **Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-OES)**.
- ICP-OES uses a plasma coupled by induction (a very high temperature ionized gas composed of electrons and positive ions) to dissociate the sample into atoms or ions. In this medium of very high energy, lead (like many other elements) emits light of characteristic wave length. The amount of light emitted can be measured and correlated with the concentration of lead in the sample.
- ICP-OES can measure lead concentrations in paint as low as 2 ppm.

How or why was the specific method chosen?:
- The method by Atomic Emission Spectrometry with Inductively Coupled Plasma (ICP-OES) was chosen according to the procedure for preparing samples in the liquid phase and of small size within the framework of the SONARA Project EVOLUTION OF THE EPC PHASE REFINING SCHEME 1 and can measure lead concentrations in paint as low as 2 ppm, in line with the international standard of 90 ppm.
Centrales

Speaker: Patrick Vivian Ngoambe

Law and Regulatory Requirements:
- In accordance with the international standard of 90 ppm promoted by the Global Alliance to Eliminate Lead Paint co-led by the United Nations Environment Program (UNEP) and the World Health Organization (WHO) the method by Atomic Emission Spectrometry with Inductively Coupled Plasma (ICP-OES) based on "ASTM E3203 Standard Test Method for Determination of Lead in Dried Paint, Soil, and Wipe Samples by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)” allows to measure lead concentrations in paint as low as 2 ppm.

Objectives of the tests:
- The objectives of the tests carried out using the Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-OES) method are as follows:
  - Provide country case studies about the use of test methods
  - Capable of measuring lead concentrations in paint as low as 2 ppm, in accordance with Cameroonian legislation, the threshold for lead in paint being required at 90 ppm;
  - Economical compared to the high volume of paints used in the SONARA Project EVOLUTION OF THE EPC REFINING SCHEME PHASE 1
  - Allows analysis of very small samples;
  - Determines the isotope ratio, which can help identify the source of the lead;
  - Very low detection limit.
Country Case Study

Centrales

Speaker: Patrick Vivian Ngoambe

Availability/effectiveness/budget:

- Availability: within the framework of the SONARA Project EVOLUTION DU SCHEMA DE RAFFINAGE EPC PHASE 1 samples were available given the high volume of paints used in the project.
- Efficiency: the tests are efficient given that the project laboratory is ISO 17025 certified
- Budget: cost of analysis of less expensive samples by the project laboratory
Country Case Study

Centrales
Speaker: Patrick Vivian Ngoambe

Key elements of the method:
– Helps determine the isotope ratio, which can help identify the source of the lead
– Reduced sample storage period compared to the proximity of the laboratory
– Argon is the only consumable product
– The maintenance cost of the devices is relatively high, because these devices are of a complex design.
– In accordance with the samples taken, the tests were carried out on wet paints

Sample paints and colors:
– Rustproof red color
– Gray primary epoxy
– Brown red polyamide epoxy primer
Country Case Study

Centrales
Speaker: Patrick Vivian Ngoambe

Testing:
− Receipt of paint pots (traceable with paint receipt report);
− Storage of paint cans in accordance with the manufacturer’s requirements;
− Opening paint cans;
− Paint homogenization;
− Sampling of quantities;
− Packaging of samples in clean containers;
− Labeling of samples;
− Performing tests;
− Results

Analysis laboratory:
− No, we did not carry out the laboratory analysis ourselves;
− After the packaging and labeling of samples, we sent them to the project laboratory
Country Case Study

Centrales
Speaker: Patrick Vivian Ngoambe

Results:
- The results of the analyzes of total lead in the paints obtained following the samples taken.
- A total of 110 samples of new paints analyzed have more than 90 ppm of total lead, and are therefore classified as lead paints according to the standard in force in the United States of America. **54 samples on lead paints** (more than 90 ppm of lead) **had a concentration greater than 600 ppm. 20 samples of the new paints analyzed were found to be lead-free paints** (lead concentration less than 90 ppm). (The highest lead concentration was 500,000 ppm (50% lead by weight) was found in a rust remover made by a local paint company. This value is 5,556 times higher than the standard value of 90 ppm.
- Our results indicate that there was a significant variation in lead concentrations in the paints analyzed, including within products manufactured by the same company.

Lessons Learned:
- We note that after receiving the results of the samples taken, the samples of the water-based paints (latex) analyzed show less than 39 ppm of lead.
Centrales

Speaker: Patrick Vivian Ngoambe

The importance of standard methods:
- Sampling is a means of selecting a subset of units from a target population for the purpose of collecting information.
- This information is used to draw conclusions about the general population, it is necessary that the sampling and testing methods are according to normative requirements in order to allow the laboratory technician to receive.

The importance of testing for the implementation of lead paint laws:
- For the implementation of laws on lead paints, it is important to carry out sampling and tests in order to provide decision-making tools to the different countries on the dangers and risks of the use of lead in paints.

Challenges/opportunities for the future:
- The results of the analyzes presented in this study on paints marketed in Cameroon call for urgent action by the government, in particular the development of a standard that limits the level of lead in paint sold or distributed in Cameroon.
- In addition, we call on manufacturers and distributors or importers of paints in Cameroon to immediately begin phasing out the use of lead in paint or to stop importing and distributing lead paints.
- Architects, engineers, and construction companies must also specify the use of paints that contain no more than 90 ppm lead.
Questions and Answers

ASTM International

- **Duration:** Ten Minutes

- Please feel free to utilize the chat and raise hand feature, located at the bottom of the tool bar:
Field Analysis Methods (Portable XRF) 

- Overview of ASTM International Standards on Using Portable X-Ray Fluorescence (XRF) Devises 
- Country Case Study 
- Q & A
E1753 Standard Practice for Use of Qualitative Chemical Spot Test Kits for Detection of Lead in Dry Paint Films

– **Scope:** This practice covers the use of commercial spot test kits based on either sulfide or rhodizonate for the qualitative determination of the presence of lead in dry paint films.
– This practice may also be used as a qualitative procedure for other dry coating films such as varnishes.
– **Significance & Use:** This technique is applicable to dry paint films and varnishes in a variety of forms including the intact dry paint film surface, a notched or other angular cut surface that exposes a cross section of all paint layers, a paint chip, and ground paint film.
– **Summary:** A dry paint film sample (a painted surface, paint chip, ground paint powder, or core sample) is tested for lead qualitatively through the use of a spot test. Spot tests kits are based on the reaction of Lead II (Pb$^{2+}$) ion with either sulfide ion (S$^{2-}$) or rhodizonate ion [C$_6$O$_6^{2-}$], resulting in the characteristic color change.
Overview ASTM Standards on Using Portable X-Ray Fluorescence (XRF) Devices in the Field

ASTM International

Speaker: Kenn White

E2119 Standard Practice for Quality Systems for Conducting In Situ Measurements of Lead Content in Paint or Other Coatings Using Field-Portable X-Ray Fluorescence (XRF) Devices

- **Scope:** This practice covers the collection and documentation of quality control (QC) measurements for determining acceptable levels of instrumental performance when using field-portable energy-dispersive X-ray fluorescence spectrometry devices (XRFs) for the purposes of generating lead classification results from measurements on paint and other coating films within buildings and related structures.

- **Significance & Use:** This practice provides procedures to generate and document QC data for ensuring that an XRF is operating within acceptable tolerances throughout the testing period when being used to collect lead results during a lead-based paint (LBP) inspection for the purposes of generating lead classification results.
Overview ASTM Standards on Using Portable X-Ray Fluorescence (XRF) Devices in the Field

Consumer Product Safety Commission (CPSC)

Speaker: Emily Matthews*

F2853 Standard Test Method for Determination of Lead in Paint Layers and Similar Coatings or in Substrates and Homogenous Materials by Energy Dispersive X-Ray Fluorescence Spectrometry Using Multiple Monochromatic Excitation Beams

- **Scope:** The test method uses energy dispersive X-ray fluorescence (EDXRF) spectrometry for detection and quantification of lead (Pb) in paint layers, similar coatings, or substrates and homogenous materials. The following material types were tested in the interlaboratory study for this standard test method: ABS plastic, polyethylene, polypropylene, PVC, glass, zinc alloy, wood, and fabric.

- This technique may also be commonly referred to as High-Definition X-ray Fluorescence (HDXRF) or Multiple Monochromatic Beam EDXRF (MMB-EDXRF).

- **Significance & Use:** This test method is used to quantify lead in paint or similar coatings, as well as in homogeneous materials. The process of quantifying lead in paint by HDXRF is faster, simpler, and safer than other common processes, such as digestion of paint in acid followed by spectroscopy. To ensure accurate quantitation, quality control measures, such as annual calibration and daily verification, are performed.

*This CPSC staff presentation has not been approved by and may not reflect the views of the Commission*
U.S. Consumer Product Safety Commission

Speaker: Emily Matthews*

- **Reason for Testing:**
  - CPSC Ban of lead in paint and similar surface coatings (16 CFR part 1303) bans furniture and children’s products that bear lead-containing paint.
  - Lead-containing paint defined as paint with lead in excess of 0.009%.
  - U.S. Consumer Product Safety Commission tests children’s products and furniture to ensure compliance with 16 CFR part 1303.

*This CPSC staff presentation has not been approved by and may not reflect the views of the Commission.
What standard methods used, and why:

- CPSC mandates that manufacturers of children’s products certify their products and be third-party tested by an accredited lab using one of two test methods to quantitate lead in paint: ASTM F2853 (X-ray fluorescence (XRF)) or a CPSC-developed method (not XRF).

- CPSC Staff uses ASTM F2853 to measure lead in paint for some samples.

- Key elements of ASTM F2853: quantitates lead in paint without having to digest it, annual calibration of the instrument is performed, daily verification is performed.

- What is tested? Each color of paint is tested.

  1) Place the painted material on the instrument and analyze.

  2) Place the unpainted material on the instrument and analyze.

- Results are given for lead in the paint and lead in the material underneath the paint in less than ten minutes.

*This CPSC staff presentation has not been approved by and may not reflect the views of the Commission.
Country Case Study

U.S. Consumer Product Safety Commission

Speaker: Emily Matthews

- **Results:**
  - CPSC has been using ASTM F2853 successfully for several years to quantitate lead in paint in children’s products.

- **Lessons Learned:**
  - ASTM F2853 is particularly useful when the amount of paint is small or cannot be easily removed and isolated.
  
  - Lead in the material underneath the paint can interfere with the measurement of lead in the paint.
  
  - With HDXRF technology, we have seen less interference of other elements on lead than with other portable XRF instruments.
  
  - Sample geometry, yearly calibration, and daily verification checks are all important.

*This CPSC staff presentation has not been approved by and may not reflect the views of the Commission.*
Country Case Study

U.S. Consumer Product Safety Commission

Speaker: Emily Matthews

Conclusions:

- ASTM F2853 has been very useful in testing small amounts of paint, as well as testing many different colors of paint in a timely fashion.

- Challenges: lead in the substrate material of a painted part can interfere with the measurement of lead in the paint.

- Limitations: to our knowledge, there is currently only one manufacturer of an instrument that can be used under ASTM F2853.

*This CPSC staff presentation has not been approved by and may not reflect the views of the Commission.*
Questions and Answers

ASTM International

- **Duration:** Ten Minutes

- Please feel free to utilize the chat and raise hand feature, located at the bottom of the tool bar:
Environmental Protection Agency (EPA)

- **Speaker:** Angela Bandemehr

- The most effective way to reduce lead paint exposure is by passing laws that restrict the use of these paints within a country.
  - The Alliance has a goal of 100 countries with lead paint laws by 2023, today there are 88 countries with these laws.

- An essential part of developing a lead law is to set a regulatory limit, as well as specify the analytical testing methods that will be used to determine whether a product is complying with the limit.

- There are multiple international standards for sampling, laboratory analysis, and field analysis and many of these standards are currently being used by countries in the region.

- It is important to continue the use of these standards, and to develop the laboratory capacity to measure lead in paint to help with the implementation of lead paint laws.
ASTM INTERNATIONAL
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Thank you!

www.astm.org
Resources/ Links

- ASTM International
- ASTM International Committee D01 on Paint and Related Coatings, Materials, and Applications
- ASTM International Committee D22 on Air Quality
- LIP COP – Is there lead in my paint? All about testing and labs
  (including discussion digest in SP, EN, FR/Video of discussion/presentations)
- LIP COP – Lead Paint Testing: Case Studies of Impact
  (including discussion digest in EN and FR/presentations)
- UNEP Model Law and Guidance for Regulating Lead Paint
- UNEP Lead in Paint Laboratory Database
- UNEP Regulatory Toolkit:
  - Module C-2: Analytical Methods for Measure Lead in Paint
  - Module C-3: Summary of Lead in Paint Testing in Low- and Middle-Income Countries
- UNEP DRAFT Lead Paint Law Compliance and Enforcement Guidance
  (draft for public comment)
- WHO Brief guide to analytical methods for measuring lead in paint, 2nd ed
# Contacts

## Testing/ Speakers

<table>
<thead>
<tr>
<th>Topic</th>
<th>Name</th>
<th>Country</th>
<th>Organization</th>
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<tr>
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<tr>
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## Case Studies/ Speakers

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## Contacts

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