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# LAC Webinar on Standard Methods for Testing Lead in Paint

29 September 2022

**Start:** 11:00 am EDT/ 10:00 am  
Panama Time or GMT-5

**End:** 2:00 pm EDT/ 1:00 pm  
Panama Time or GMT-5

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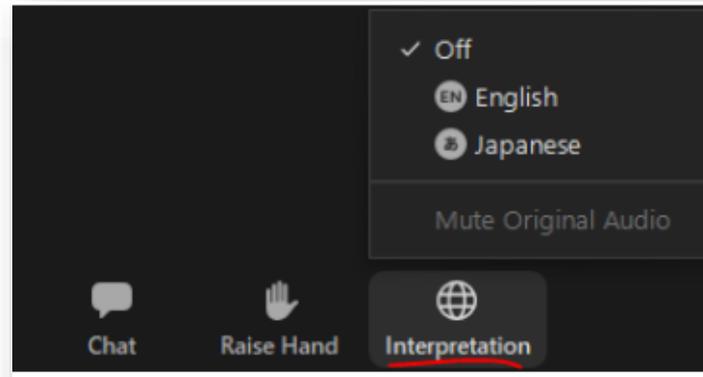
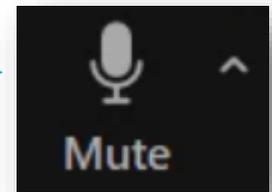
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# Welcome!

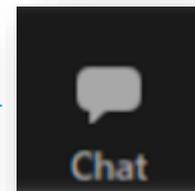


## Introduction to the Zoom platform and Meeting Procedures

- **Moderator:** Jim Olshefsky
- **Interpreter:** Juan Dejo
- 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



Regional Coordinator on Chemicals and Pollution, United Nations  
Environment Programme (UNEP) Latin American and the Caribbean Office

– **Speaker:** Jordi Pon



# 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

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## World Health Organization (WHO)

**Speaker:** Elena Jordan

**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

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## World Health Organization (WHO)

**Speaker:** Elena Jordan

- 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

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## World Health Organization (WHO)

**Speaker:** Elena Jordan

- 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 Jordan

### – **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 Jordan

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 Jordan

### 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

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## World Health Organization (WHO)

**Speaker:** Elena Jordan

- 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 Jordan

*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

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## World Health Organization (WHO)

**Speaker:** Elena Jordan

- 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

# Summary



## World Health Organization (WHO)

**Speaker:** Elena Jordan

- 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 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>



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# 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



**for a toxics-free future**



# 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

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# Paint Purchase



## International Pollutants Elimination Network (IPEN)

**Speaker:** Jeiel Guarino

- Purchase of paints is dependent on the type and color of paints with the potential for high lead content.

Type of Paint
Solvent-based paint
Oil-based paint
Alkyd paint
Enamel paint
Primer/Anticorrosive paint
Aerosol/spray paint

Color of Paint
Yellow
Red
Orange
Green
Others (white, pink, grey, brown, black, blue)

- The choice to analyze these types of paints and specific colors were made to find lead paint sold on the market.



# 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.

# Overview of ASTM Standards for Sample Preparation and Methodologies



## ASTM International

**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.

# Overview of ASTM Standards for Sample Preparation and Methodologies



## ASTM International

**Speaker:** Kenn White

### **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.

# Overview of ASTM Standards for Sample Preparation and Methodologies

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## ASTM International

**Speaker:** Kenn White

### **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).

# Overview of ASTM Standards for Sample Preparation and Methodologies



## ASTM International

**Speaker:** Kenn White

### **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

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## 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

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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



# ISO/IEC 17025: Risk Management



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## Internal context (within the management system)

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

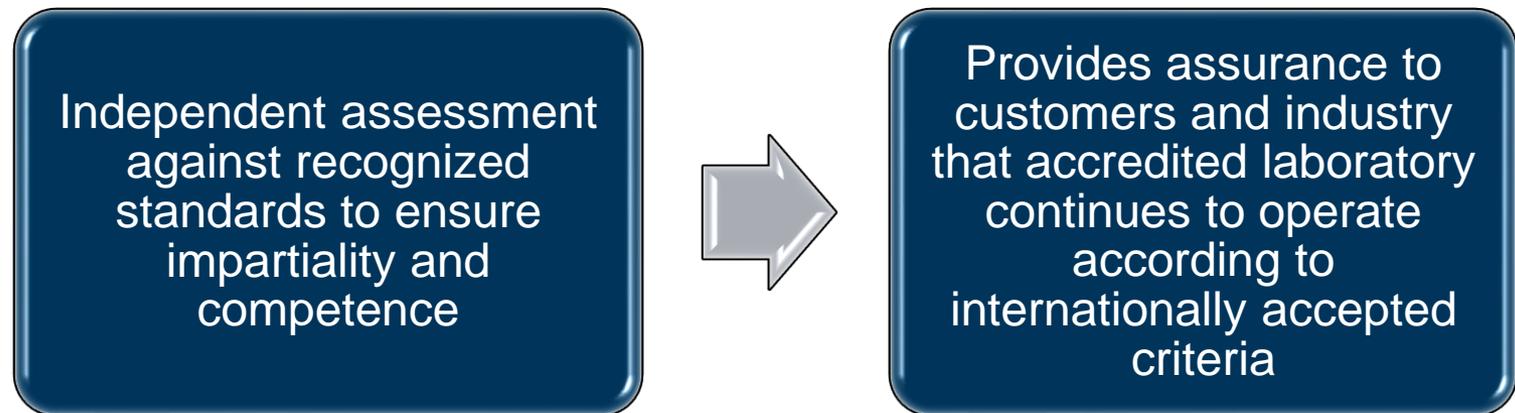
## External context (based on management system outcomes)

- Reporting/nonconforming work/customer service
  - Reputation
  - Confidence
  - Financial

# ISO/IEC 17025: Accreditation



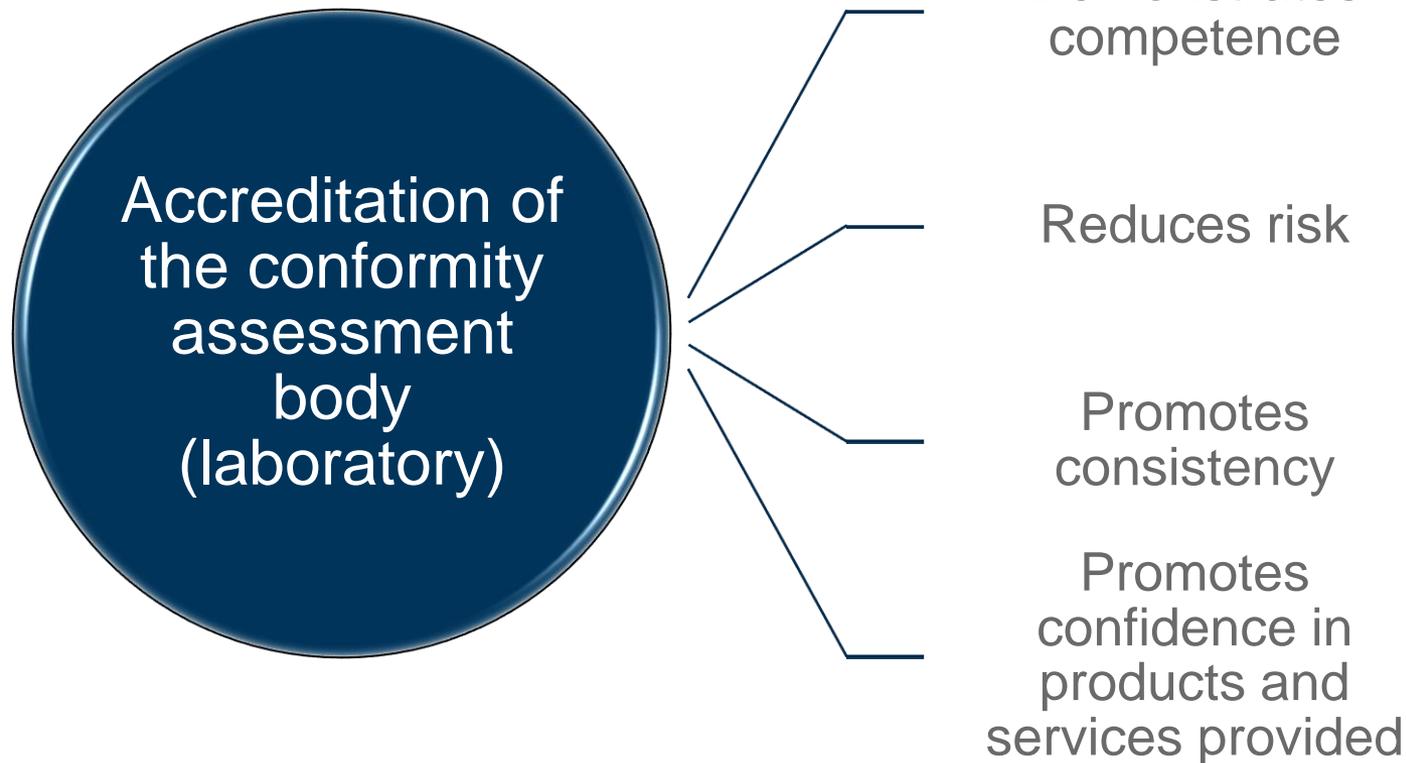
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# Accreditation to ISO/IEC 17025



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# ISO/IEC 17025: Accreditation Process



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- 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

# ISO/IEC 17025: Accreditation



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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 reincorporated 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: Sampling and Sample Preparation Methods

Johann Antoine

ASTM Webinar:  
Standard for Paint Lead Testing for Latin  
America and the Caribbean 29 September  
2022



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## Reason for Sampling:

- Research: Paint samples were collected as a part of Pure Earth’s Toxic Site Identification Program (TSIP). Initially there was **random sampling of white, yellow, and red domestic paints and coatings**. Eventually based on an expanded budget there was **increased sampling which began randomly but really extended into convenience sampling**.
- Development and **promulgation of a compulsory standard**, at that time, the Draft Jamaican Standard Specification for the Limit of Lead Content in Paints (DJS 358:2022). The limit for the standard was set at 90 mg/kg. Paint samples selected by the National Compliance and Regulatory Authority (NCRA), were collected from the Bureau of Standards Jamaica.
- Commercial activity/consultancy: The University of the West Indies’ Occupational and Environmental Safety and Health (OESH) Programme for one of the public utilities. **Paint was analyzed on-site and then layers of paint were carefully collected from old buildings and structures** and analyzed at our laboratories.

- **X-Ray Fluorescence Spectrometry was employed** (Primarily portable but also desktop)
- The technique was chosen for the following reasons:
  - Good accuracy
  - Immediate Results
  - Low use costs
  - Non-destructive
  - Rapid
- Paint was analysed in **wet and dry form**.
- Paint containers were opened, homogenized, and an aliquot pipetted carefully into disposable XRF X-Cell™ sample cups and covered with XRF Mylar® TF-160 Thin films.
- **Detection limit achieved was between 3 and 7 mg/kg.**



- In the case of the TSIP there were **only two paints that had detectable Pb with the higher level being 12.1 mg/kg**. For the survey related to DJS 358:2022 there were several samples with detectable Pb but specifically **one sample, an automotive paint, had 104.7 mg/kg of Pb**.

Sample ID	Pb mg/kg
1-Green/Blue paint (western wall)	1329.0 ± 23
2- Red paint (mix) (below green)	1382±25
3- Red paint (site#3)	27.3±5.1
4- Red paint (above floor site#4)	40.2 ± 4.9
5- Cream paint (Post/Column)	<5

- **Random Stratified Sampling:** The initial sampling came with some pre-conceived notions when considering the goals of the TSIP. This meant that it was relatively easy to miss whole categories of paints that may have given greater information about the paints on the market at that time. The ICENS had less control over the subsequent sampling except to suggest what we felt we had missed based on previous sampling.

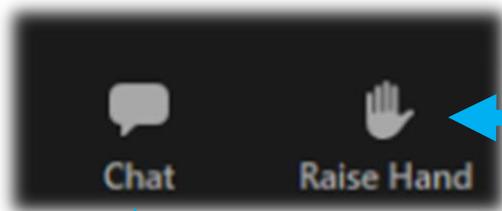
- **A robust testing regime is integral** in supporting compliance with compulsory standards, technical regulations, and laws limiting lead in paints.
- **There is a major opportunity for the testing market for lead in paints** to open up to several analytical laboratories including the ICENS. A major challenge will be to develop the type of sampling regime that will be scientifically canvas the market well enough to ensure that what is being tested is representative.
- **It may help that some of the voluntary standards being adopted in Jamaica can bring guidance.** e.g., ISO 15528:2020 Paints, varnishes and raw materials for paints and varnishes — Sampling
- The consultancy activity indicated the **need for the sampling of older structures and paints**, less from a compliance point of view and more from the aspect of exposure.

# Questions and Answers



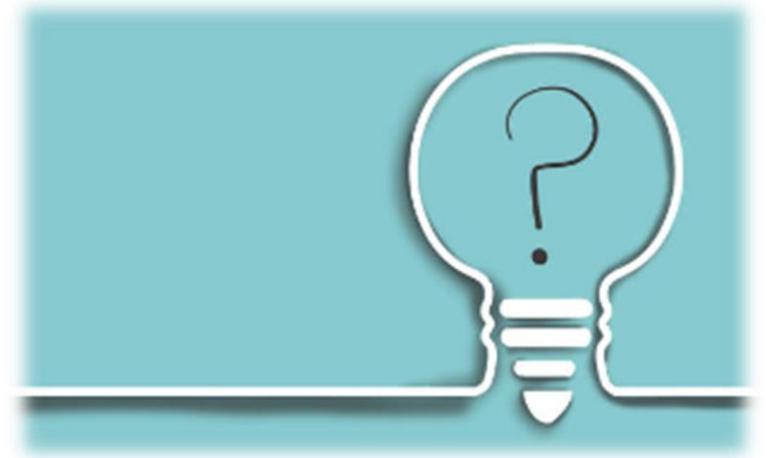
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- **Duration:** Ten Minutes
- Please feel free to utilize the chat and raise hand feature, located at the bottom of the tool bar.



↑  
Chat feature

←  
Raise  
hand  
feature



# Break (Ten minutes)





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# 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<sup>2</sup> 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

– <sup>2</sup>Vandeberg, J. T., Swafford, H. D., and Scott, R. W., “Determination of Low Concentrations of Lead in Paint,” *Journal of Paint Technology*, Vol 47, No. 604, May 1975.

# 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  $\mu\text{g/mL}$  (approximately three times standard deviation of blank) with an Optimum Linear Range Upper Limit of 10  $\mu\text{g/mL}$

# Overview of ASTM Standards for Lab Analysis



## ASTM International

**Speaker:** Kenn White

### **E3203 Standard Test Method for Determination of Lead in Dried Paint, Soil, and Wipe Samples by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)**

- **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  $\mu\text{g}$  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  $\mu\text{g}$  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

# Overview of ASTM Standards for Lab Analysis



## ASTM International

**Speaker:** Kenn White

### **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**

- **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.

# Overview of ASTM Standards for Lab Analysis



## ASTM International

**Speaker:** Kenn White

### **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:

# Laboratory Analysis of Lead in Paints

**Johann Antoine**

ASTM Webinar:  
Standard for Paint Lead Testing for Latin  
America and the Caribbean 29 September  
2022



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## Reason for Sampling:

- This testing was done only in **support of the development for DJS 358: 2022 - Draft Jamaican Standard Specification for the Limit of Lead Content in Paints**. The spectrometer was new and the work to be done was primarily method development.
- Better Limits of Detection and accuracy,
- Still relatively affordable if laboratory is available and only few samples,
- No technical limitations,
- Non-destructive,
- Can be used to analyse wet and dry paint,
- Fairly rapid analysis.



- The major test objective was to determine just how **accurate the results of the portable XRF analysers were in comparison to the bench-top/laboratory XRF** using several samples.
- Quality control included the use of spiked paint samples, quality control materials, as well as analysis in triplicate.
- A variety of brands and colours were selected as previously mentioned.
- The limit of detection was **~ 0.5 mg/kg**



Paint Sample	Portable XRF	Tabletop ED-XRF
26735	$3.8 \pm 1.9$	$2.1 \pm 0.1$
26743	$7.7 \pm 2$	$5.0 \pm 0.1$
26745	<1.1	$1.1 \pm 0.17$
26750	<1.1	<0.3
26751	$104.7 \pm 3.6$	$99 \pm 2.0$
26753	$3.5 \pm 1.8$	$2.6 \pm 0.1$

**There was a reasonable agreement between the results of the portable XRF analyser and the ED-XRF spectrometer.** As an additional aspect of quality control we could consider the results of the portable XRF to be reasonable. The recovery from spiked samples and the precision of the replicates were also assessed as reasonable.

- The initial test objectives were achieved in that the analysis was relatively rapid, precise, and better limits of detection were achieved. The non-destructive nature of the testing made is easier to repeatedly test between the portable and table-top spectrometers with relative ease.
- **It may still be useful for the sake of accuracy to explore the use of Atomic Absorption Spectrophotometry (AAS)**, for example not only for a better assessment of accuracy but also to achieve the best limits of detection.



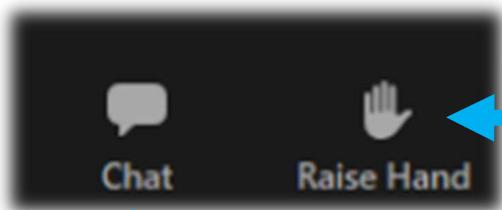
**Thermo Scientific iCE 3500 AA Spectrometer  
with integrated graphite furnace**

# 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 feature

Raise hand feature



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## Field Analysis Methods (Portable XRF)

- Overview of ASTM International Standards on Using Portable X-Ray Fluorescence (XRF) Devices
- Country Case Study
- Q & A

# Overview ASTM Standards on Using Chemical Spot Test Kits in the Field



## ASTM International

**Speaker:** Kenn White

### **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 ( $\text{Pb}^{2+}$ ) ion with either sulfide ion ( $\text{S}^{2-}$ ) or rhodizonate ion [ $\text{C}_6\text{O}_6^{2-}$ ], 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



# Country Case Study: Analysis of Lead in Paints with Portable XRF Spectrometers

**Johann Antoine**

ASTM Webinar:  
Standard for Paint Lead Testing for Latin  
America and the Caribbean 29 September  
2022



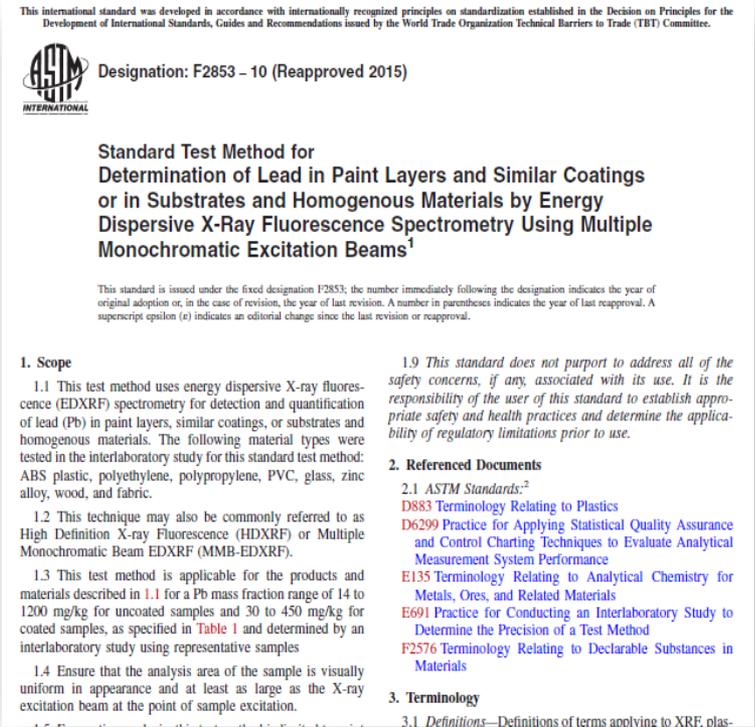
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## Reason for Testing:

- Develop Promulgation of DJS 358:2022
- Toxic Site Identification Program for Pure Earth/Research
- Occupational and Environmental Safety and Health
- The technique was chosen for the following reasons:
  - Good accuracy
  - Immediate Results
  - Low use costs
  - Non-destructive
  - Rapid
- Paint containers were opened, homogenized, and an aliquot pipetted carefully into disposable XRF X-Cell™ sample cups and covered with XRF Mylar® TF-160 Thin films.
- Detection limit achieved was between 3 and 7 mg/kg.



NIST Standard Reference Materials 2570 Lead Paint Film for Building Surfaces (Blank) (Color: White) and 2571 Lead Paint Film for Building Surfaces (Nominal Pb 3.5 mg/cm<sup>2</sup>) (Color: Yellow) used for quality control.

Reference Material	Expected	Observed
SRM 2570 –White (Blank)	<0.001	<Limit of Detection
SRM 2571 –Yellow	3.58 ± 0.39	3.73 ± 0.01

### Spiking of paint sample

100 ppm and 500 ppm standards were made up from a 1000 ppm standard of lead. Approximately 5g of paint was pipetted into XRF cells in triplicate. 1 g of the 100 ppm, 500 ppm and 1000 ppm was added to each paint sample, respectively. The spiked samples were analyzed using the portable Niton Xlt. The results obtained were recorded and compared to the theoretical values. Recoveries were 110%, 98% and 94% respectively.

<b>Paint Sample</b>	<b>Pb (mg/kg)</b>
EDGECEM PAINTS GLOW FLAT WHITE QRT	3.8 ± 1.9
EDGECEM PAINTS HIGH GLOSS LACQUER	<0.9
EDGECEM PAINTS SUPER GLOSS SPAR VARNISH	1.5 ± 0.8
EDGECEM PAINTS COLOR GLOW PLUS GLOSS PAINT WHITE QT	14.2 ± 2.5
BERGER 303 2549F ANTIQUE WHITE	<2.8
BERGER 404 2549G WHITE	<3.1
BERGER RUST PRO 2549E BLACK	3.8 ± 1.6
SHERWIN WILLIAMS KEM ENAMEL 2549I POST OFFICE RED	<1.3
SHERWIN WILLIAMS INDUSTRIAL ENAMEL 2549K WHITE	7.7 ± 2
AUTOMOTIVE ART 2552B BLACK	<0.8
AUTOMOTIVE ART 2552C METALLIC BRIGHT	<1.1
MAINWAX POLYURETHANE 2549H WARM GLOSS	<0.9
SHERWIN WILLIAMS FURNITURE FINISHES 2549H.V CLEAR LACQUER FLAT	<0.9
EDGECEM 2549B FLAT LACQUER	<0.9
SHERWIN WILLIAMS KEM ENAMEL MOBAY WHITE	<0.9
AUTOMOTIVE ART MOBAY BASE COAT	<1.1
Sample BLUE	104.7 ± 3.6
AUTOMOTIVE ART MOBAY 2K SINGLE STAGE	9.0 ± 1.0
DIAMOND D100 MOBAY TEENAGE PINK	3.5 ± 1.8
EDGE CHEM FLAT EMULSION GARDENIA	5.7 ± 2.0
BERGER EVERGLOWACRYLIC EMULSION PAINT LOW SHEEN PAWPAW	<2.6
BERGER EVERGLOW ACRYLIC EMULSION PAINT DRAGON FLY	<2.5
EDGE CHEM COLOR GLOW PLUS LOW SHEEN EMULSION CREAM	<2.1

Paint Sample	Pb (mg/kg)
Berger 404 Oil Gloss Citronella	<5
Berger 404 Oil Gloss Post Office Red	12.73
Berger 404 Oil Gloss Ash Grey	<5
Sherwin Williams Flat Emulsion White	<5
Berger 303 Flat Emulsion White	<5
Sherwin Williams Marine Spar Varnish	<5
Berger 404 Oil Gloss White	7.04
Berger 404 Oil Gloss Spanish Brown	<5
Edge Chem Oil Gloss Black	<5
Sherwin Williams Flat Emulsion Black	<5
Berger 303 Flat Emulsion Black	<5
Sherwin Williams Super Kem Gloss White	<5
Sherwin Williams Marine Coating Brown	<5
Sherwin Williams Enamel Black	<5
Sherwin Williams Acrylic Primer Grey	<5
Edge Chem Oil Paint Fiesta Red	<5
Edge Chem Oil Paint Black	<5
Edge Chem Quick Dri Enamel White	<5
Edge Chem Quick Dri Enamel Post Office Red	<5
Edge Chem Quick Dri Enamel Black	<5
Edge Chem Oil Paint White	<5
Edge Chem Red Oxide Primer	<5
Edge Chem Oil Paint Sundance Yellow	<5
Edge Chem Universal Primer	<5
Edge Chem Quick Dri Enamel Sundance Yellow	<5

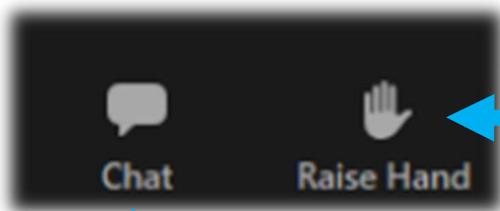
- The experience of lead testing of paints has indicated that portable X-ray fluorescence is a suitable technique in terms of accuracy and precision. There are additional advantages such as **in-situ testing and rapid results**. The typical portable XRF spectrometer will have limits of detection and sensitivity that are fit for purpose in determining lead results significantly lower than 90 mg/kg.
- Although there are several advantages to the use of portable XRF analyzers for use in-situ and even laboratory analysis **there are also limits to what can be deduced from the results**. While in most jurisdictions there may be no impediment to using these instruments in others it may be better as a screening tool. For instance in looking at areic mass measurements of 0.5 mg/cm<sup>2</sup> as an action result the portable analyzer is not looked at as an appropriate technique by certain organizations. It may be that laboratory analysis is necessary when looking at results intended for interpretation of occupational exposure.

# 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:



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# Closing Remarks



## 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 in 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.



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# Resources/ Links



- [ASTM International](#)
- [ASTM International Committee D01 on Paint and Related Coatings, Materials, and Applications](#)
- [ASTM International Committee D22 on Air Quality](#)
- [ICENS – International Centre for Environmental and Nuclear Sciences](#)
- [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, 2<sup>nd</sup> ed](#)

# Contacts



Topic	Name	Country	Organization	Email
<b>Testing/ Speakers</b>				
ISO 17025	Matthew Sica	United States	Matthew Sica Consulting	<a href="mailto:matthew.j.sica@gmail.com">matthew.j.sica@gmail.com</a>
ISO 6503	Abe Msibi	South Africa	South African Bureau of Standards	<a href="mailto:abe.msibi@sabs.co.za">abe.msibi@sabs.co.za</a>
ISO 1513	Abe Msibi	South Africa	South African Bureau of Standards	<a href="mailto:abe.msibi@sabs.co.za">abe.msibi@sabs.co.za</a>
ASTM F2853	Emily Matthews	United States	U.S. Consumer Safety Commission	<a href="mailto:ematthews@cpsc.gov">ematthews@cpsc.gov</a>
IPEN Paint Sampling Methods in the Field	Jeiel Guarino		International Pollutants Elimination Network (IPEN)	<a href="mailto:jeielguarino@ipen.org">jeielguarino@ipen.org</a>
Brief guide to analytical methods/ Opening Remarks	Elena Jordan		World Health Organization (WHO)	<a href="mailto:jardane@who.int">jardane@who.int</a>

Topic	Name	Country	Organization	Email
<b>Case Studies</b>				
LAC - Testing	Johann Antione	Jamaica	International Centre for Environment and Nuclear Sciences of the University of the West Indies	<a href="mailto:Johann.antoine@uwimona.edu.jm">Johann.antoine@uwimona.edu.jm</a>
LAC - Sampling	Johann Antione	Jamaica	International Centre for Environment and Nuclear Sciences of the University of the West Indies	<a href="mailto:Johann.antoine@uwimona.edu.jm">Johann.antoine@uwimona.edu.jm</a>
LAC - XRF	Johann Antione	Jamaica	International Centre for Environment and Nuclear Sciences of the University of the West Indies	<a href="mailto:Johann.antoine@uwimona.edu.jm">Johann.antoine@uwimona.edu.jm</a>

# Contacts



Topic	Name	Country	Organization	Association/ Committee	Email
<b><u>ASTM International Speakers</u></b>					
ASTM E1729, E1728/E1728M, E1727, WK82689, E1645, E1644, E1726, E1979, E3193, E3203, D6785, E1613, E1583, E1753, E2119,	Kenneth T. (Kenn) White	United States	MS, MM, CIH, CSP, FAIHA, FASTM Principle, Consultant Services	ASTM International Chair, D22.12 Vice Chair (Membership), D22	<a href="mailto:kennwhite@cox.net">kennwhite@cox.net</a>
ASTM D3335	Andrew Burris	United States	South Coast AQMD	ASTM International Chair, D01.21	<a href="mailto:aburris@aqmd.gov">aburris@aqmd.gov</a>

# Contacts



Name	Country	Organization	Email
<b>Staff/ Support</b>			
Angela Bandemehr	United States	EPA/ Senior International Program Manager	<a href="mailto:bandemehr.angela@epa.gov">bandemehr.angela@epa.gov</a>
Ashley Wiand	United States	ASTM International/ TCO Manager/ D22 Committee	<a href="mailto:awiand@astm.org">awiand@astm.org</a>
Craig Updyke	United States	ASTM International/ Director, Global Policy & International Trade	<a href="mailto:cupdyke@astm.org">cupdyke@astm.org</a>
Jen Tursi	United States	ASTM International/ TCO Manager/ D01 Committee	<a href="mailto:jtursi@astm.org">jtursi@astm.org</a>
Jim Olshesky	United States	ASTM International/ Director, External Relations	<a href="mailto:jolshesky@astm.org">jolshesky@astm.org</a>
Jordi Pon	Latin America & the Caribbean	Regional Coordinator on Chemicals and Pollution, UNEP Latin American & the Caribbean Office	<a href="mailto:jordi.pon@un.org">jordi.pon@un.org</a>
María Isabel Barrios	Lima, Peru	ASTM International/ Representante Cooperación Global América Latina	<a href="mailto:mbarrios@astm.org">mbarrios@astm.org</a>
Maria Jiverage	United States	ASTM International/ Manager, Global Cooperation	<a href="mailto:mjiverage@astm.org">mjiverage@astm.org</a>
Meghan Ramler	United States	EPA/ Water Division   Permitting & Grants Branch   NPDES Permitting Section	<a href="mailto:wahlstrom-ramler.meghan@epa.gov">wahlstrom-ramler.meghan@epa.gov</a>
Teresa Cendrowska	United States	ASTM International/ Vice President, Global Cooperation	<a href="mailto:rowska@astm.org">rowska@astm.org</a>