



BUREAU VERITAS |

**Developing a Commercial Testing
Procedure for Spent Auto Catalyst**

Move Forward with Confidence



**BUREAU
VERITAS**



Bureau Veritas

Established in 1828, Bureau Veritas is a global leader in Testing, Inspection & Certification services in the areas of Quality, Health & Safety, Environment and Social Responsibility across eight global businesses.

Move Forward with Confidence



**BUREAU
VERITAS**



Inspectorate Metals & Minerals



INSPECTORATE

Analysis – the Challenge

To obtain an accurate, quantitative result of the metal content of the sample.

Our example in this case is the testing of Platinum, Palladium & Rhodium in spent Auto Catalyst material

Sampling quality is of course key, but for the sake of this presentation we will assume that the sample is homogenous.



INSPECTORATE

Analysis – the Challenge

- ▶ We don't necessarily know the material you have sent us.
- ▶ We don't know the Matrix of the material you have sent us.
- ▶ Certified Reference Materials (CRMs) will be limited for the material you have sent us.
- ▶ The clock is ticking....



INSPECTORATE

Analysis – What are the key considerations?

- 1) Sample Heterogeneity
- 2) Matrix & Pollutants
- 3) Precision between replicates



INSPECTORATE

Analysis – What are the key considerations?

- 4) Method Bias
- 5) Reference Material
- 6) Application



INSPECTORATE

Analysis – What are the Options?

- ▶ Acid digestion or alkali fusion followed by *Inductive Coupled Plasma (ICP OES) or Atomic Emission Spectroscopy (AAS)* without any matrix separation
- ▶ Acid digestion or alkali fusion with matrix separation (e.g., tin/tellurium) and ICP OES
- ▶ XRF (Energy Dispersive or Wavelength Dispersive) by fusion, pressed pellet or directly on the loose powder
- ▶ Fire Assay collection by nickel sulphide and ICP OES
- ▶ Fire Assay collection with added gold and ICP OES

N.B. We do utilise XRF to determine a preliminary 'pilot' analysis on each received sample.



INSPECTORATE

Our Selection: Fire Assay Collection and ICP OES

- ▶ ISO 17025 Accredited Method
- ▶ Removes the Matrix
- ▶ Allows a greater sample weight to be taken
- ▶ Covers a wider range of sample materials
- ▶ Removes the need for Nickel Sulphide
- ▶ Allows for an ICP OES quantification



INSPECTORATE

Our Procedure: Fire Assay Collection and Digestion

- ▶ XRF preliminary test to determine platinum, palladium and rhodium and the composition of the matrix
- ▶ Use of the XRF data to optimise replicate weights
- ▶ Fire Assay litharge fusion with a double slag wash and added gold as a collector
- ▶ Controlled cupellation to recover the gold containing the platinum, palladium and rhodium
- ▶ Acid digestion of the gold (platinum, palladium and rhodium)



INSPECTORATE

Our Analysis – Final determination ICP OES

- ▶ Strict control of Acid Concentration.
- ▶ Selection of the most appropriate internal standards.
- ▶ Expert selection of the correct ICP wavelength matched to the most appropriate internal standard.
- ▶ Introduction of calibration standards by weight (not volume) to optimise accuracy.
- ▶ Internal standards added by weight (not volume) to optimise accuracy.



INSPECTORATE

Our Analysis – Data Review

Use our Laboratory Information Management System (LIMS) software to cross reference:

- ▶ Precision between replicates
- ▶ CRM performance
- ▶ Refer back to initial preliminary XRF pilots



INSPECTORATE

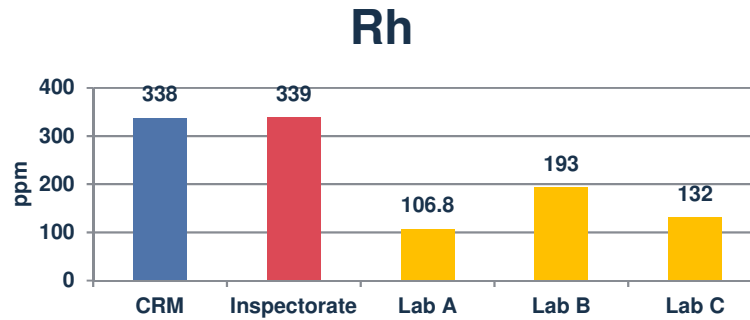
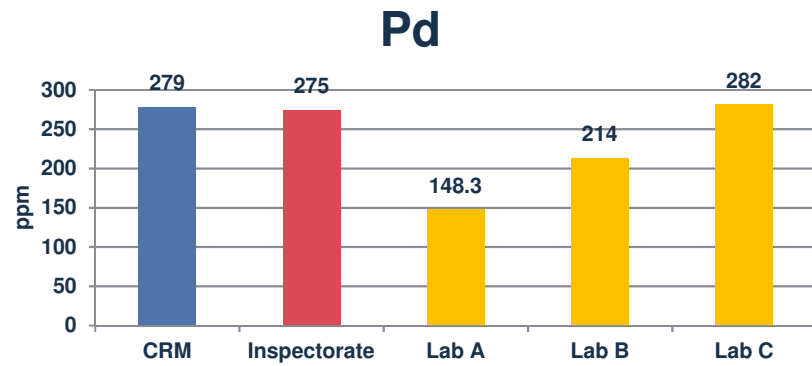
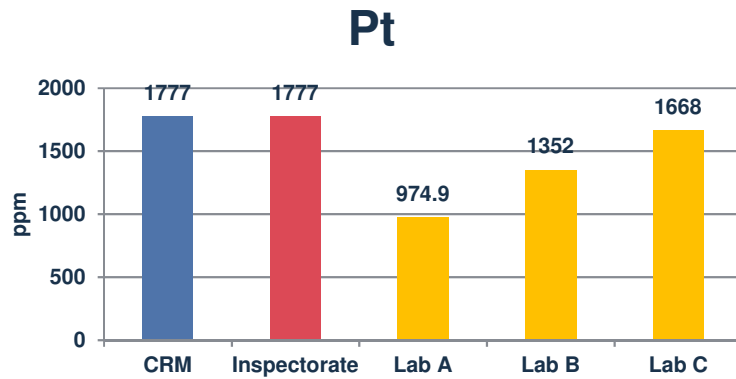
What can Inspectorate offer you ?

- ▶ 150 years of experience - fully independent
- ▶ Proven methods and methodologies
- ▶ Strong global technical resource
- ▶ Strong internal Code of Ethics enforcement
- ▶ Participation in global round robins – bench mark our performance



INSPECTORATE

Round Robins - All Assay Labs are Not Created Equal



Example is a CRM currently in use



INSPECTORATE

Inspectorate Witham Laboratory - Endorsements



IPMI (International Precious Metals Institute) Patron Member and 2003/2004 & 2012/2013 Presidency.



UKAS, ISO 17025 and 9001:2008 compliant



LBMA

LBMA (London Bullion Market Association) Associate Members and registered supervisor of pro-active monitoring scheme



LPPM Affiliate members and registered supervisor of the pro-active monitoring scheme



INSPECTORATE



BUREAU
VERITAS

Move Forward with Confidence



INSPECTORATE



Appendix

Move Forward with Confidence



**BUREAU
VERITAS**

- **Introduction**
- **Key Figures**
- **Geographic Footprint**

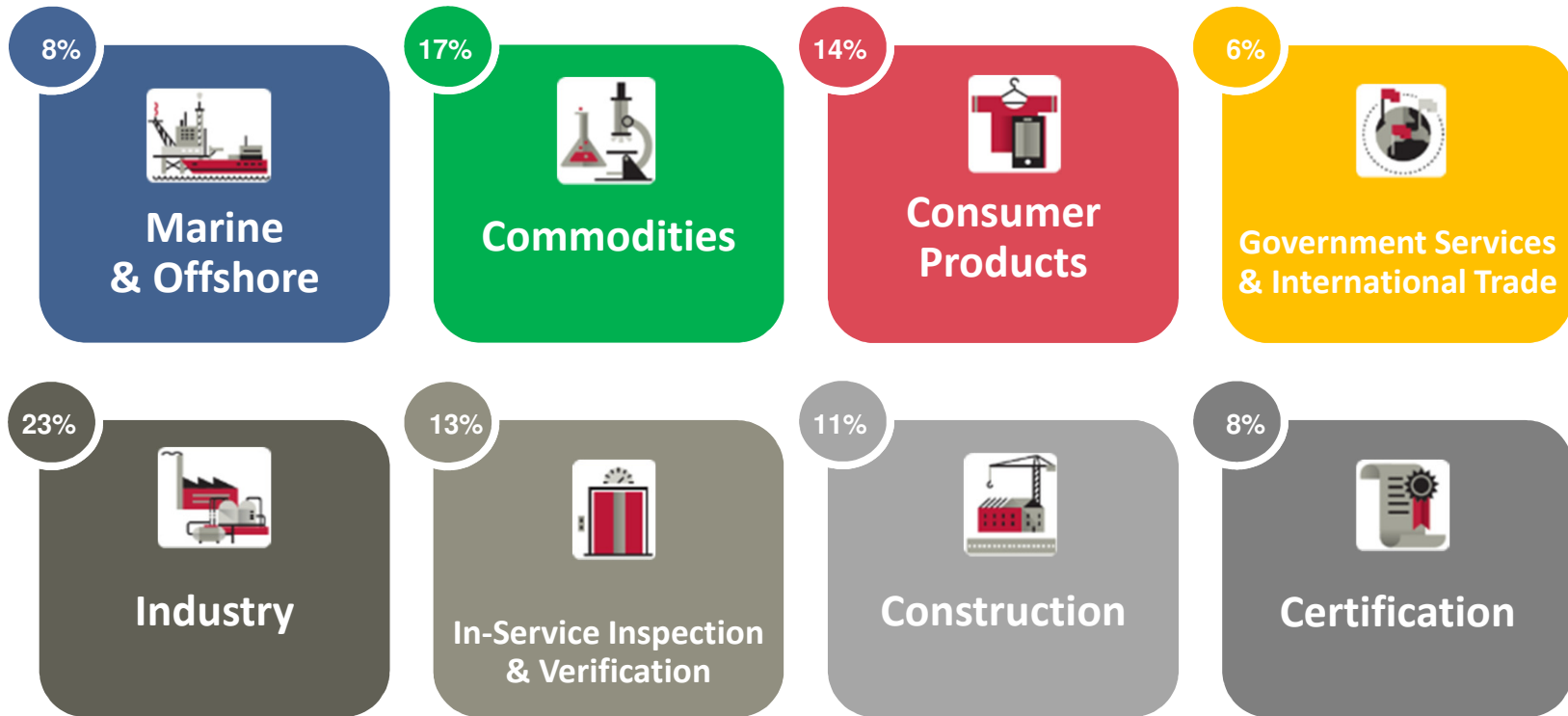
BUREAU VERITAS **COMPANY OVERVIEW**

Move Forward with Confidence



BUREAU
VERITAS

8 GLOBAL BUSINESSES
2015 REVENUE: €4.6 BILLION



GLOBAL SUPPORT NETWORK GEOGRAPHIC FOOTPRINT

EMEA

- 660 offices and laboratories
- 23,400 staff
- 88 countries



Asia-Pacific

- 410 offices and laboratories
- 23,000 staff
- 22 countries



Americas

- 330 offices and laboratories
- 20,100 staff
- 30 countries



Global network comprising of 66,500 employees in 1400 offices and laboratories across 140 countries. Inspectorate was acquired in 2010 and is a core part of Bureau Veritas' Commodities Operations

- **Scope of Services**
- **Geographic Footprint**
- **Memberships & Accreditations**
- **Competitive Advantage**

Metals & Minerals



INSPECTORATE

INSPECTION SERVICES

Working from the world's major ports and mining and refining locations, our aim is to minimize commercial risk by accurately and swiftly determining the physical properties of materials through supervision of weighing, sampling, pre-shipment, load and discharge inspection.



LEADING INSPECTION SERVICES

- **Load and Discharge Supervision and Inspection**
- **Weight Determination**
- **Vault and Storage Facility Auditing Services**
- **Consultancy Services**



INSPECTORATE

TESTING SERVICES

Inspectorate employs a combination of experience and cutting-edge technology to report on elemental levels and chemical properties. Wherever your interest lies, Inspectorate can help you achieve a commercial settlement which truly represents the value of the consignment.



TESTING SERVICES

- **Sampling and Sample Preparation Supervision Services**
- **High Precision Assaying**
- **Transportable Moisture Limit (TML)**



INSPECTORATE

OUR COMMODITIES

Whatever commodity you are involved with whether mined, refined or manufactured, Inspectorate will act as your “eyes and ears” wherever you need us. We can mobilize our teams within a few hours if necessary.



COMMODITIES RANGE

- **Steel Raw Materials**
- **Coal, Coke and Biomass**
- **Non-Ferrous Metals**
- **Precious Metals: Gold, Silver and Platinum Group Metals (PGM)**
- **Precious Metals: Catalyst**
- **Electronic Scrap**



INSPECTORATE

SOLID FUELS

Our independent inspection, weighing, sampling and testing services are available worldwide to monitor the supply chain and minimise or eliminate the risks associated with the movement of bulk cargo. We have an array of expertise that covers the full range of solid fuels, including energy and coking coals, coke, pet-coke and biomass.



KEY BENEFITS

- Extensive global network offers rapid turnaround time from sampling to certification
- Umpire or arbitration assaying to support commercial settlement
- ISO 17025 accredited laboratories in key exporting and importing countries
- Overcome sampling and quality problems with training and consultancy services.



INSPECTORATE

GLOBAL METALS & MINERALS LABORATORY NETWORK



INSPECTORATE

MEMBERSHIPS & ACCREDITATIONS

Inspectorate is represented on the global testing and inspection governing bodies and the majority of our global laboratory network is accredited to ISO 17025 ensuring our equipment, methods and quality control meet the highest standards set by the industry.

MEMBERSHIPS & ACCREDITATIONS

Memberships

- International Federation of Inspection Agencies (IFIA)
- International Precious Metals Institute (IPMI)
- Bureau of International Recycling (BIR)

Accreditations & Certifications

- ISO 17025
- ISO 9001
- ISO 14001; OHSAS 18001



INSPECTORATE

ETHICS & COMPLIANCE

- All operations governed by adherence to strict Bureau Veritas Code of Ethics*
- Integrity and traceability of test results subject to audit
- Our umpire laboratory awarded “Invest in Integrity” Charter mark
- Excellent track record in external round robin including suppliers, refiners and standards organisations
- Regular internal proficiency testing exercises serve to check ongoing competency



INSPECTORATE

Competitive Advantage

150+ YEARS OF TECHNICAL EXCELLENCE

Efficient Global Network

- Unique combination of international and local networks
- Consistency of service delivery across the globe
- Reactivity to deploy new service capabilities

Brand and Reputation

- Strong brand built over 150 years of technical excellence, integrity & independence
- Ability to recruit talent
- Attractiveness for acquisition targets

Unmatched Expertise

- Comprehensive portfolio of accreditations and certifications
- Thorough knowledge of regulations, reference frameworks and standards
- Extensive knowledge of market sectors

Skilled Employee Base

- Strong technical expertise
- Entrepreneurial and client-driven culture

Broad Service Portfolio

- Ability to cover all QHSE requirements of a project / customer

What else can Inspectorate offer you ?

Pre Shipment

- ▶ Supervision of catalyst unloading
- ▶ Pre shipment sampling and analysis
- ▶ Sealing of drums/containers. Ensure the integrity of the consignment.
- ▶ Inspection or audit of Refinery. An independent report of the facilities.

At Reprocessor

- ▶ Supervision of the sampling process
- ▶ Recommendations of appropriate sampling methods

- ▶ Consultation



INSPECTORATE

MOVE FORWARD WITH CONFIDENCE

Our global network of professional Metals & Minerals Trade experts are dedicated to providing our leading services to customers across the globe.

Contact us today so we can tailor a solution to meet your needs.



CONTACT DETAILS

N. America +1 281 848 5816

S. America +56 2350 2100

Europe +44 1376 536 800

Middle East +966 3 361 3330

Asia-Pacific +65 6866 3019

Africa +44 1376 536 800

(International Co-ordination Team)

E-Mail

client.services@inspectorate.com

Websites

www.inspectorate.com/metals

www.bureauveritas.com



INSPECTORATE