

# Schedule of Services & Charges 2023

Minerals Services  
Philippines



# Providing services across the resources supply chain.

Intertek is a leading Total Quality Assurance provider to industries worldwide. Our network of more than 1,000 laboratories and offices and over 46,000 people in more than 100 countries, delivers innovative and bespoke Assurance, Testing, Inspection and Certification solutions for our customers' operations and supply chains. Intertek supports companies' success in the global marketplace, by helping customers to meet end users' expectations for safety, sustainability, performance, integrity and desirability in virtually any market worldwide.

Our network of mineral laboratories offer world class geochemical assay and testing services including sample preparation, fire assay and precious metal analysis, exploration geochemistry, environmental testing, mine-site laboratories, coal testing and inspection, consulting minerals inspection, robotics and automated laboratory systems.

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**Quality analysis,  
efficient, independent,  
& cost-effective service.  
Global scope, local presence.**

100 Countries.  
1000 Laboratories.  
44,000 Employees.



# Intertek Minerals Global Centre of Excellence

A new technology and innovation centre with a focus on automation and sustainability to provide our clients with faster, safer, higher quality, and more efficient analytical solutions.

Minerals Global Centre of Excellence, is located in Perth, Western Australia, a key global centre for the minerals and mining industry. This new bespoke space consolidates Minerals operations into a 20,000sqm facility housing over 500 employees. The state-of-the-art laboratory will support our customers in the mining and minerals industry, giving them access to trusted expertise in mineral testing, inspections and analysis. Providing a broad portfolio of services under one roof significantly enhances delivery of our Total Quality Assurance (TQA) customer promise and streamlines our superior customer service.

The new facility was established to inspire innovation and sustainability across the minerals supply chain, with advanced technology, automation and robotics.



## Robotics and Automation

As the leader in operating automated robotic laboratory systems for the mining industry, Intertek's new facility includes eight robotic automated systems, including sample preparation, XRF and wet chemistry systems. Utilising advanced technology and innovation with a strong focus on automation, Intertek provides our customers with faster, more efficient analytical options that increase production without compromising on quality.

## Specialised testing services

- Supporting the industry to drive a low carbon society.
- Rare earth and alkali earth and battery metals utilising a range of cutting-edge geochemistry techniques.
- High-quality analysis of platinum group elements.
- Consultative customised solutions.

## MineralSpace

A key feature of the new Intertek Minerals Global Centre of Excellence is MineralSpace, a unique multifunctional dedicated customer space. This collaborative, immersive and multiple configurational venue is available to our customers and industry bodies for presentations, technical seminars, workshops and events.

- Multiple configurable venue space.
- 4.8-metre interactive screen allowing 32 separate touchpoints.
- Instant access to our world-class technical experts and services.

## Sustainability

True to our purpose, Bringing Quality, Safety and Sustainability to Life, this new facility features 3030 x330W solar panels making it one of largest rooftop solar installations in Western Australia. The facility will also capture and recycle laboratory wastewater to conserve this precious resource.



# Technology and Innovation

## Minalyzer CS

Partnering with Minalyze has allowed Intertek Minerals to install a Minalyzer CS into our Global Centre of Excellence allowing our clients geological data acquisition and access to related software for data visualisation.



Minalyzer CS is a scanner which is a contactless and non-destructive service that generates geochemistry, high-resolution images, rock quality designation (RQD), structures, specific gravity and bulk density for drill cores and other drill samples. The patented scanner is designed for handling large volumes of drill samples and is capable of scanning drill cores directly in core trays. A laser (LiDAR) generates a 3D-model of the topology of the core and trays, which enables the control and precision of the continuous XRF scanning. RQD and structures are also derived based on the 3D-model.

The objective, continuous and consistent nature of the datasets as well as the high but compact data density generated by the scanning technology is paramount in machine learning and deep learning applications and approaches to geology. Machine learning and deep learning have been demonstrated to be effectively used, based on the data from the scanning, for the prediction of host rock lithologies.

A range of datasets are available generated from one scan;

- **Photography:** High-resolution digital image of sample of spatial resolution of 12 pixels/mm with consistent light conditions.
- **Topography:** High-resolution grey scale or colored digital topology model of sample in 3D X,Y and Z point cloud format.
- **Chemical Analysis:** Continuous X-ray Fluorescence (XRF) analysis on 1 m, 10 cm and custom intervals. Elemental range between Sodium (Na) to Uranium (U) depending on settings.
- **Specific Gravity/Bulk Density:** Specific Gravity (SG) estimations using the X-SG method or bulk density using volumetric estimation depending on core type.
- **Rock Quality Designation:** Rock quality designation (RQD) on desired intervals. Client can generate it digitally by using Minalogger and designating which fractures are mechanical or natural.
- **Structural logging:** Measurement of Alpha and Beta angles on structural features. Client can measure it digitally by using Minalogger where core have orientation line, and Alpha angle could be measured on.

Access to the Minalyze cloud-based software [www.minalogger.com](http://www.minalogger.com) can be provided for visualisation and generation of datasets through digital tools and allows for remote access to a digital version of the drill sample.



# Chrysos PhotonAssay

Chrysos PhotonAssay  
technology added to Minerals  
Global Centre of Excellence  
in Perth.



Intertek Minerals has partnered with Chrysos Corporation to install three Chrysos PhotonAssay units at the new Minerals Global Centre of Excellence.

Using much higher energies than traditional X-ray methods, Chrysos PhotonAssay detects and counts atoms of gold in as little as two minutes. PhotonAssay allows large samples to be measured and provides a true bulk reading independent of the chemical or physical form of the sample. Using uniquely numbered sample jars, the process is completely non-destructive, and all samples can be retained for further analysis or testing if required. The technology is also measurably safer and more environmentally friendly than previous assay processes, something that aligns with Intertek's stated purpose of bringing quality, safety, and sustainability to life.

For gold producers Chrysos PhotonAssay delivers faster, more accurate gold analysis on larger samples with lower costs.

- More representative sample analysis and results
- Improved definition of reserves and resources
- Lower labour requirements, less chance of human error and/or accident
- Reduced supply chain cost, reliance and management



# Applications

MINING DEVELOPMENT PHASES →



The most common methods offered are listed in this Schedule, however this is not an exhaustive list of services and not all services are available at all locations, We encourage clients to discuss their projects with us and where possible visit the laboratories to assist with the selection of the most appropriate analytical solutions for the particular application.

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# Sample Preparation

The production of a homogeneous sub-sample, representative of the material submitted to the laboratory is the primary purpose of sample preparation. Correct preparation is critical to obtaining meaningful analytical results. The selection of the actual sample preparation procedures will depend on the type and size of the sample, the mineralogy as well as the client's analytical and budgetary requirements.

Segregation into high and low grade sample preparation areas and utilisation of techniques such as vacuuming pulveriser vessels and/or quartz washes between samples reduces the potential for contamination. Robotic preparation employing quartz washes is also available at some facilities.

Close and ongoing consultation with your laboratory manager or sales representative will ensure that optimal sample preparation techniques are employed thus maximising the value added in the analytical process.



## Sample Submission

Correct submission and receipt of samples is critical in retaining the integrity of the sample chain of custody and facilitating efficient processing of samples. Detailed instructions can be found on Page 33 and submission forms can be downloaded from the Intertek website [www.intertek.com/minerals](http://www.intertek.com/minerals)

Sample submission and freight information emailed prior to despatch will expedite the sample receipt process. Upon receipt, samples are issued with a unique barcode ID through the LIMS. Clients are encouraged to submit pre barcoded samples to enable efficient sample receipt and reconciliation.

## Sample Storage

All solid samples (assay pulps, bulk pulps and residues) will be stored without charge for 90 days after completion of analysis. After this time all samples will be stored at a daily rate until the client's written advice regarding return, collection or disposal is received.

Description	Code	Price
Storage of bulk, pulp or residue samples	ST101	₱1336.50/m <sup>3</sup> /month
Disposal of samples	ST201	₱14100.00/t
Expenses related to return	ST30	At cost
Retrieval of selected pulps	ST401	₱18.50/each
Retrieval of selected coarse/fine residues	RT101	₱49.30/each

## Freight

Freight expenses incurred will be passed on at cost.

## Ore Transport Certificates

For the freighting of pulp samples from the remote sample preparation facilities to Manila, the securing of the OTC from the MGB will be charged at cost as long as the original OTC for the delivery of the samples to the laboratory is received.

## Sample Preparation Packages

To facilitate easy selection of sample preparation procedures, commonly used techniques have been packaged together.

### Partial Pulverise Package

Description	Code	Price
Sort, dry (105°C), crush (95%<10mm), riffle split, pulverise 1.5kg (95%<75µm) up to 2.0kg	SP121	₱299.50
Additional weight	SP122	₱74.00/kg
Sort, dry (105°C), crush (95%<2mm), riffle split, pulverise 1.5kg (95%<75µm) up to 2.0kg	SP132	₱326.50
Additional weight	SP133	₱81.50/kg

### Total Preparation Package

Description	Code	Price
Sort, dry (105°C), crush, pulverise all (95%<75µm) up to 1.5kg	SP111	₱299.50
Additional weight	SP113	₱97.50/kg

### Soil and Stream Sediment

Description	Code	Price
Sort, dry (105°C), pulverise all (95%<75µm) up to 1.5kg	SP101	₱253.00
Additional weight	SP103	₱97.50/kg
Sort, desegregate, dry 105°C & dry Sieve 180µm, reporting fraction weights up to 1.5kg	SP104	₱152.00
Additional weight	SP105	₱55.50/Kg

# Sample Preparation Procedures

## Drying

Sample drying procedures will vary due to the sample type and mass, moisture content and analysis required.

Description	Code	Price
Sort and dry samples received in standard paper packets	SD01	₱41.00
Sort and dry samples at 105°C	SD02	₱54.50/kg
Sort and dry samples at 60°C	SD03	₱62.00/kg
Sort and dry samples at 80°C	SD05	₱62.00/kg

## Crushing

Samples with a volume or dimensions exceeding that which the pulverising vessels can accommodate may require crushing and/or splitting prior to pulverising. Crushing may also be required to achieve an optimum particle size to split to a representative sub sample for further particle size reduction.

Description	Code	Price
Crush to ~10mm	CR01	₱31.00/kg
Crush to ~2mm	CR02	₱64.50/kg

## Splitting

Splitting of samples may be done to achieve a more cost effective option in reducing the volume of sample for further particle size reduction steps.

Two types of splitters are used; the riffle splitter, sometimes called a Jones Splitter and the Rotary Splitter. It is important to select the correct size splitter for the product being split, correct technique is also important in order that samples are split without introducing bias.

Description	Code	Price
Riffle splitting - up to 6kg discard reject	RF01	₱74.00
Riffle splitting - up to 6kg retain reject	RF02	₱123.50
Rotary or arcual splitting	RS01	₱49.50/kg

## Pulverising

Pulverising is carried out on crushed or fine products to achieve a fine homogeneous powder to enable small sub-samples to be taken for analysis that will be representative of the larger coarse sample. For most sample types at least 95% of material will be pulverised to 75µm or better.

All devices used in the crushing and pulverising of samples can impart trace levels of contaminants. Low chrome steel is often the preferred material of choice for pulverising vessels as the chrome and iron contamination is usually negligible compared with the levels commonly encountered in most geological materials.

Description	Code	Price
Coarse pulverise 95% < 850µm	CPU101	₱86.50/kg
Fine pulverise, 95% < 75µm, up to 1.5kg	PU102	₱92.50
Fine pulverise, 95% < 75µm, additional weight	PU104	₱89.00/kg
Quartz wash (discarded)	QW01	₱49.50
Quartz wash (retained)	QW02	₱68.00

## Sieving

Sieving may be performed on unprocessed samples to determine the mass distribution of the various size fractions or alternatively, on crushed or pulverised products to ascertain the effectiveness of the preparation processes.

Description	Code	Price
Dry sieve specified mesh size 1 fraction	SV101	₱277.50/kg
Dry sieve to specified mesh sizes additional fractions	SV101A	₱136.00/kg
Wet sieve (retain oversize only)	SV102	₱302.00/kg
Wet sieve (recovering undersize & oversize)	SV102A	₱739.50/kg
Quality check sizing - 75µm	SV103	₱92.50/kg
Quality check sizing - 2mm	SV108	₱92.50/kg

## Miscellaneous Procedures

Description	Code	Price
Client specified preparation (technician)	CP01	₱739.50/hr
Client specified preparation (chemist)	CP02	₱1170.50/hr
Roasting, pulp only up to 200g	PR01	₱296.00
Reporting weights of samples, wet or dry		₱25.00/component

Other sample preparation processes (preparation of carbons, magnetic or heavy media separation, compositing and homogenising etc) are also available. Please contact the laboratory to discuss your requirements.

# Precious Metals Analysis

A diverse range of precious metal analytical techniques are available for a wide range of applications ranging from grassroots exploration, where sub ppb sensitivities are required, to accurate resource estimation and grade control.

Lead collection fire assay remains the classic method for gold, platinum and palladium, however, aqua regia digestion, accelerated cyanide leach and BLEG (bulk leach extractable gold) are available for specific purposes. The full suite of platinum group elements can be quantified using nickel sulphide collection fire assay. Please contact us to discuss your specific requirements.



## Lead Collection Fire Assay

Fire assay flux recipes have been carefully formulated to optimise precious metal recovery in diverse mineralogical matrices. Further flux modification and reduction in charge weight can be used to improve recoveries in difficult sample matrices.

Element	Description	Detection Limit	Code	Price
Au	30g fire assay / AAS	0.01ppm	FA30/AA	₱618.00
Au	50g fire assay / AAS	0.005ppm	FA50/AA	₱689.50
Au	30g fire assay, new pots / AAS	0.01ppm	FA30N/AA	₱671.50
Au	50g fire assay, new pots / AAS	0.005ppm	FA50N/AA	₱742.50
Au, Pt, Pd	50g fire assay / OES	5ppb	FA50/OE	₱1146.50
Au	Activated carbon by fire assay	10ppm	FAC/GR	₱1261.50
Au	Activated carbon by fire assay	1ppm	FAC/AA	₱1261.50
Au	30g fire assay / Gravimetric	6ppm	FA30/GR	₱732.00
Au	50g fire assay / Gravimetric	3ppm	FA50/GR	₱737.00

Concentrates, metallurgical and high grade samples POA

The full suite of Platinum Group metals (Pt, Pd, Rh, Ru, Ir & Os) on geological materials can be analysed at our specialist facility in Perth by nickel sulphide collection fire assay POA

## Screen Fire Assay

Screen fire assays utilise a large sample mass, typically 1kg, and find application where the precious metal compositional and distributional heterogeneity in a pulp is such that a conventional fire assay would be accompanied by an unacceptable sampling error. The pulp sample is screened and the entire coarse fraction is fired assayed to recover the gold and/or PGEs. Duplicate assays are carried out on the more reproducible undersize fraction. The precious metal content is reported as a mass weighted mean along with the individual fractions' results.

Element	Description	Detection Limit	Code	Price
Au	Screen fire assay 106µm, single undersize analysis / AAS	0.01ppm	SF106/AA1	₱1693.00
Au	Screen fire assay 75µm, single undersize analysis / AAS	0.01ppm	SF75/AA1	₱1930.50
Au	Screen fire assay 106µm, duplicate undersize analysis / AAS	0.01ppm	SF106/AA2	₱2358.50
Au	Screen fire assay 75µm, duplicate undersize analysis / AAS	0.01ppm	SF75/AA2	₱2620.00

## Cyanide Leaches

Cyanide solutions are used to leach gold from large samples providing a useful method for both grassroots exploration and resource work and are usually performed on screened stream sediment samples, providing detection of low level anomalies for regional exploration.

### Cyanide Bottle Roll

Element	Description	Detection Limit	Code	Price
Au	500g leach / MS	0.001ppm	CN500/MS	₱1366.50
Au	1.0kg leach / MS	0.001ppm	CN1000/MS	₱1485.00
Au	2.0kg leach / MS	0.001ppm	CN2000/MS	₱1604.00
Additional Elements	Ag (0.01), Cu (0.2), Pt (0.002), Pd (0.002), Cd (0.005), Co (0.01), Ni (0.1), Zn (0.5), As (0.05), Mo (0.002), Bi (0.005), Hg (0.02)		per element	₱36.00
Au	20g leach / AAS	0.02ppm	CN20/SAA	₱700.00
Au	500g leach / AAS	0.01ppm	CN500/SAA	₱853.00
Au	1.0kg leach / AAS	0.01ppm	CN1000/SAA	₱974.50
Au	2.0kg leach / AAS	0.01ppm	CN2000/SAA	₱1045.50
Additional Elements	Ag (0.1), Cu (0.2)		per element	₱65.50

# Exploration Geochemistry

The challenge of identifying geochemical anomalies related to concealed mineral deposits has driven innovation and development in analytical geochemistry.

Advances in instrumentation and methodology offer significant improvements in aligning detection limits with elemental crustal abundances and provide exceptional long term data reproducibility.

A number of exploration methods are offered including partial selective leaches, biogeochemical analyses, aqua regia digestions and near-total four acid digestions. The selection of the most appropriate method is critical to achieving the most successful outcome for your exploration project.

The most commonly used analytical procedures are listed, however this is not an exhaustive list and we encourage you to contact your local manager to discuss your specific requirements. Not all methods and packages listed are available at all locations.



# Aqua Regia Digestion for Gold + Multi-Elements

The advent of new analytical instrumentation technologies coupled with streamlined, ultra clean aqua-regia digestion methods provide the best platform for fast, cost effective and consistent trace level analysis for your exploration samples.

The aqua regia digestion is a classical empirical digestion technique with successful global application in geochemical exploration. Most oxide, sulphide and carbonate minerals are digested, however, refractory minerals and most silicates may be only partially decomposed. Recovery levels will vary between the elements and sample matrices with indicative recoveries highlighted on the package tables.

Samples containing graphitic or organic material may require roasting prior to digestion.

## Aqua Regia Digestion Packages

Aqua regia digestion coupled with ICP-OES and ICP-MS offers a cost effective option for gold and multi-element packages.

### Aqua Regia ICP-OES Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 100	Fe	100 - 10%	Sc	1 - 500
Al	20 - 10%	K	20 - 5%	Se	20 - 1000
As	5 - 1%	La	2 - 500	Sn	20 - 1000
B	10 - 1%	Li	1 - 500	Sr	1 - 5000
Ba	2 - 2000	Mg	100 - 10%	Te	20 - 1000
Be	1 - 1000	Mn	1 - 1%	Ti	50 - 5%
Bi	2 - 5000	Mo	1 - 5000	V	2 - 1%
Ca	100 - 10%	Na	100 - 5%	W	20 - 2000
Cd	1 - 1000	Ni	1 - 2%	Y	2 - 500
Ce	20 - 1000	P	20 - 2%	Zn	1 - 5000
Co	1 - 5000	Pb	3 - 5000	Zr	2 - 5000
Cr	2 - 1000	S	50 - 5%		
Cu	1 - 1%	Sb	5 - 5000		
Aqua regia digestion 0.5g			AR005/OE101	₱986.50	

### Aqua Regia Standard ICP-OES & MS Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Au**	1ppb - 500ppb	Hg*	0.05 - 100	Sb	0.05 - 5000
Ag	0.05 - 250	In	0.05 - 1000	Sc	1 - 500
Al	20 - 10%	K	20 - 5%	Se	1 - 5000
As	1 - 5000	La	0.01 - 500	Sn	0.5 - 200
B*	10 - 1%	Li	0.1 - 1000	Sr	0.2 - 5000
Ba	1 - 2000	Mg	0.01% - 20%	Ta	0.05 - 200
Be	0.5 - 1000	Mn	1 - 1%	Te	0.05 - 1000
Bi	0.05 - 5000	Mo	0.1 - 5000	Th	0.05 - 500
Ca	0.01% - 40%	Na	0.01% - 5%	Ti	5 - 1%
Cd	0.05 - 1000	Nb	0.2 - 200	Tl	0.05 - 1000
Ce	0.01 - 1000	Ni	1 - 1%	U	0.05 - 5000
Co	0.1 - 5000	P	20 - 2%	V	2 - 1000
Cr	1 - 1%	Pb	0.5 - 5000	W	0.1 - 200
Cs	0.02 - 500	Pd**	10ppb - 500ppb	Y	0.05 - 200
Cu	1 - 1%	Pt**	5ppb - 500ppb	Zn	1 - 1%
Fe	0.01% - 50%	Rb	0.05 - 1000	Zr	0.5 - 200
Ga	0.1 - 500	Re	0.05 - 500		
Hf	0.05 - 200	S*	100 - 5%		
Aqua regia digestion 1g / ICP-OES & ICP-MS			AR01/OM10	₱1556.50	
Aqua regia digestion 10g / ICP-OES & ICP-MS			ARU10/OM10	₱1830.00	
Aqua regia digestion 25g / ICP-OES & ICP-MS			ARU25/OM10	₱1948.50	

Note: \* B, Hg, S are only available on 1g option, Hg may report low due to losses in sampling and preparation.  
 \*\* Au, Pt, Pd are indicative only on 1g option and must be interpreted with extreme caution.

## Aqua Regia Comprehensive ICP-OES &amp; MS Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Au**	1ppb - 500ppb	Hg*	0.01 - 100	Sb	0.02 - 5000
Ag	0.05 - 250	Ho	0.01 - 200	Sc	0.1 - 500
Al	20 - 10%	In	0.005 - 1000	Se	1 - 5000
As	1 - 5000	K	20 - 5%	Sm	0.01 - 500
B*	10 - 1%	La	0.01 - 500	Sn	0.05 - 200
Ba	1 - 2000	Li	0.1 - 1000	Sr	0.02 - 5000
Be	0.05 - 1000	Lu	0.005 - 200	Ta	0.01 - 200
Bi	0.01 - 5000	Mg	0.01% - 20%	Tb	0.005 - 200
Ca	0.01% - 40%	Mn	1 - 1%	Te	0.01 - 1000
Cd	0.01 - 1000	Mo	0.1 - 5000	Th	0.01 - 500
Ce	0.01 - 1000	Na	0.01% - 5%	Ti	5 - 1%
Co	0.1 - 5000	Nb	0.02 - 200	Tl	0.01 - 1000
Cr	1 - 1%	Nd	0.01 - 500	Tm	0.01 - 100
Cs	0.01 - 500	Ni	0.5 - 1%	U	0.01 - 5000
Cu	0.5 - 1%	P	20 - 2%	V	2 - 1000
Dy	0.01 - 200	Pb	0.5 - 5000	W	0.05 - 200
Er	0.01 - 200	Pd**	10ppb - 500ppb	Y	0.02 - 200
Eu	0.01 - 200	Pr	0.005 - 500	Yb	0.01 - 200
Fe	0.01% - 50%	Pt**	5ppb - 500ppbb	Zn	1 - 1%
Ga	0.05 - 500	Rb	0.02 - 1000	Zr	0.1 - 200
Gd	0.05 - 200	Re	0.001 - 500		
Hf	0.01 - 200	S*	50 - 5%		

Aqua regia digestion 1g / ICP-OES & ICP-MS	AR01/OM20	₱2317.00
Aqua regia digestion 10g / ICP-OES & ICP-MS	ARU10/OM20	₱2435.50
Aqua regia digestion 25g / ICP-OES & ICP-MS	ARU25/OM20	₱2697.00

Note: \* B, Hg, S are only available on 1g option, Hg may report low due to losses in sampling and preparation

\*\* Au, Pt, Pd are indicative only on 1g option and must be interpreted with extreme caution

## Individual Elements by Hydride AAS

Element	Range ppm	Element	Range ppm
As	1 - 100	Sb	1 - 100
Aqua regia digestion / Hydride AAS per element		AR005/AAH	
		₱214.00	

Elements where the concentration exceeds the upper limit will be re-digested by the appropriate analytical method, which will incur additional charges.

## Aqua Regia Digestion Individual Elements

A selection of individual elements is offered to enable suites to be customised to suit your specific needs, or where only a few elements are required.

## Aqua Regia ICP-OES Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 250	Cu	1 - 1%	Pb	1 - 5000
Al	20 - 10%	Fe	0.01% - 50%	S*	50 - 5%
As	5 - 5000	K	20 - 5%	Sb	5 - 5000
B*	10 - 1%	La	2 - 500	Sc	1 - 500
Ba	2 - 2000	Li	1 - 1000	Sr	1 - 5000
Bi	2 - 5000	Mg	0.01% - 20%	Te	20 - 1000
Ca	0.01% - 40%	Mn	1 - 1%	Ti	5 - 1%
Cd	0.5 - 1000	Mo	1 - 5000	Tl	5 - 1000
Ce	20 - 1000	Na	0.01% - 5%	V	2 - 1000
Co	1 - 5000	Ni	1 - 1%	W	20 - 2000
Cr	2 - 1%	P	20 - 2%	Zn	1 - 1%

## Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

### Aqua Regia ICP-MS Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Au	1ppb - 500ppb	Hf	0.01 - 200	Sc	0.1 - 200
Ag	0.05 - 200	Hg*	0.01 - 100	Se	1 - 5000
Al	10 - 1%	Ho	0.01 - 200	Sm	0.01 - 500
As	1 - 2000	In	0.005 - 1000	Sn	0.05 - 200
Ba	1 - 1000	La	0.01 - 500	Sr	0.02 - 1000
Be	0.05 - 1000	Li	0.1 - 1000	Ta	0.01 - 200
Bi	0.01 - 200	Lu	0.005 - 200	Tb	0.005 - 200
Ca	20 - 1%	Mg	5 - 1%	Te	0.01 - 200
Cd	0.01 - 500	Mn	1 - 5000	Th	0.01 - 500
Ce	0.01 - 500	Mo	0.1 - 500	Ti	5 - 1%
Co	0.1 - 1000	Nb	0.02 - 200	Tl	0.01 - 200
Cr	0.5 - 5000	Ni	0.5 - 5000	Tm	0.01 - 100
Cs	0.01 - 500	Nd	0.01 - 500	U	0.01 - 5000
Cu	0.5 - 5000	Pb	0.5 - 1000	V	1 - 2000
Dy	0.01 - 200	Pd	10ppb - 500ppb	W	0.05 - 200
Er	0.01 - 200	Pr	0.005 - 500	Y	0.02 - 200
Eu	0.01 - 200	Pt	5ppb - 500ppb	Yb	0.01 - 200
Fe	10 - 1%	Rb	0.02 - 1000	Zn	1 - 5000
Ga	0.05 - 500	Re	0.001 - 500	Zr	0.1 - 200
Gd	0.05 - 200	Sb	0.02 - 500		

\*B, Hg, S are only available on 1g option, Hg may report low due to losses in sampling and preparation.

### Aqua Regia AAS Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 250	Cr	5 - 1%	Ni	5 - 2%
As	5 - 1%	Cu	5 - 2%	Pb	5 - 5000
Bi	5 - 5000	Fe	100 - 50%	Sb	5 - 1%
Cd	5 - 1000	Mn	5 - 1%	Zn	5 - 2%
Co	5 - 5000	Mo	5 - 5000		

Description	Code	Price
Aqua regia digestion 1g		₱582.50
/ ICP first element		
/ secondary instrument first element	AR01/OM	₱374.50
/ per additional ICP element		₱37.00
Aqua regia digestion 10g		₱772.50
/ ICP first element		
/ secondary instrument first element	AR10/OM	₱374.50
/ per additional ICP element		₱37.00
Aqua regia digestion 25g		₱879.50
/ ICP first element		
/ secondary instrument first element	AR25/OM	₱374.50
/ per additional ICP element		₱37.00

### Mercury by Cold Vapour AAS

Element	Range ppm			
Hg	0.1			
Aqua regia digestion / Cold Vapour AAS for Mercury	Individual digest	AR01/CV01	₱428.00	
	Combined digest with elements above	AR01/CV01	₱285.50	

Legend		
Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery

## Four Acid Digestion Multi-Element Analysis

Four acid digestion offers a “near total” dissolution of almost all minerals species, targeting silicates not dissolved in less aggressive aqua regia digests. Carefully staged digestion steps minimise losses due to volatilisation of some elements.

Highly resistant refractory minerals such as zircon, cassiterite, columbite-tantalite, ilmenite, xenotime rutile, barite and wolframite will require a fusion digestion to guarantee complete dissolution.

Packages range from basic ICP-OES only suites through to a comprehensive element list utilising both ICP-OES and ICP-MS for ultra-trace levels. Individual elements are available on request.

### Four Acid ICP-OES Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 500	K	20 - 10%	Sb	5 - 1%
Al	50 - 15%	La	5 - 5000	Sc	1 - 5000
As	10 - 1%	Li	1 - 5000	Se	20 - 2000
Ba	2 - 5000	Mg	20 - 40%	Sn	20 - 2000
Bi	5 - 1%	Mn	1 - 2%	Sr	1 - 1%
Ca	50 - 40%	Mo	5 - 1%	Te	20 - 2000
Cd	0.5 - 2000	Na	20 - 10%	Ti	5 - 2%
Ce	20 - 1%	Nb	20 - 2000	Tl	10 - 2000
Co	1 - 1%	Ni	1 - 2%	V	1 - 5000
Cr	5 - 2%	P	50 - 5%	W	20 - 2000
Cu	1 - 2%	Pb	5 - 1%	Zn	1 - 2%
Fe	100 - 50%	S	50 - 10%	Zr	2 - 2000
4A/OE01				₱1063.50	

### Four Acid Standard ICP-OES & MS Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.1 - 500	In	0.05 - 2000	Se	2 - 1%
Al	50 - 15%	K	20 - 10%	Sn	0.1 - 2000
As	2 - 1%	Li	0.1 - 5000	Sr	0.5 - 1%
Ba	1 - 5000	Mg	20 - 40%	Ta	0.05 - 2000
Be	0.5 - 2000	Mn	1 - 2%	Te	0.1 - 2000
Bi	0.05 - 1%	Mo	0.1 - 1%	Th	0.05 - 5000
Ca	50 - 40%	Na	20 - 10%	Ti	5 - 2%
Cd	0.05 - 2000	Nb	0.1 - 2000	Tl	0.02 - 2000
Co	0.1 - 1%	Ni	1 - 2%	U	0.05 - 1%
Cr	5 - 2%	P	50 - 5%	V	1 - 5000
Cs	0.1 - 2000	Pb	1 - 1%	W	0.1 - 2000
Cu	1 - 2%	Rb	0.1 - 2000	Y	0.1 - 2000
Fe	100 - 50%	Re	0.05 - 2000	Zn	1 - 2%
Ga	0.1 - 2000	S	50 - 10%	Zr	0.5 - 2000
Ge	0.1 - 2000	Sb	0.1 - 1%		
Hf	0.1 - 2000	Sc	1 - 5000		
4A/OM10				₱1901.00	

### Rare Earth Elements Add On

Rare earth elements are available as a supplementary package.

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ce	0.1 - 1%	Ho	0.1 - 2000	Sm	0.1 - 5000
Dy	0.1 - 2000	La	0.1 - 5000	Tb	0.05 - 2000
Er	0.1 - 2000	Lu	0.05 - 2000	Tm	0.1 - 2000
Eu	0.1 - 2000	Nd	0.1 - 5000	Yb	0.1 - 2000
Gd	0.1 - 2000	Pr	0.05 - 5000		
4A/MS11				₱428.00	

**Comprehensive ICP-OES & MS Package**

Element	Range ppm		Element	Range ppm		Element	Range ppm	
Ag	0.05	- 500	Hf	0.05	- 2000	Sb	0.05	- 1%
Al	50	- 15%	Ho	0.01	- 2000	Sc	0.1	- 5000
As	0.5	- 1%	In	0.005	- 2000	Se	0.5	- 1%
Ba	0.1	- 5000	K	20	- 10%	Sm	0.01	- 5000
Be	0.05	- 2000	La	0.01	- 5000	Sn	0.1	- 2000
Bi	0.01	- 1%	Li	0.1	- 5000	Sr	0.05	- 1%
Ca	50	- 40%	Lu	0.005	- 2000	Ta	0.01	- 2000
Cd	0.02	- 2000	Mg	20	- 40%	Tb	0.005	- 2000
Ce	0.01	- 1%	Mn	1	- 2%	Te	0.05	- 2000
Co	0.1	- 1%	Mo	0.1	- 1%	Th	0.01	- 5000
Cr	1	- 2%	Na	20	- 10%	Ti	5	- 2%
Cs	0.05	- 2000	Nb	0.05	- 2000	Tl	0.02	- 2000
Cu	0.5	- 2%	Nd	0.01	- 5000	Tm	0.01	- 2000
Dy	0.01	- 2000	Ni	0.5	- 2%	U	0.01	- 1%
Er	0.01	- 2000	P	50	- 5%	V	1	- 5000
Eu	0.01	- 2000	Pb	0.5	- 1%	W	0.1	- 2000
Fe	100	- 50%	Pr	0.005	- 5000	Y	0.05	- 2000
Ga	0.05	- 2000	Rb	0.05	- 2000	Yb	0.01	- 2000
Gd	0.01	- 2000	Re	0.002	- 2000	Zn	1	- 2%
Ge	0.05	- 2000	S	50	- 10%	Zr	0.1	- 2000

4A/OM20

₹2435.50

Elements where the concentration exceeds the upper limit will be re-digested by the appropriate analytical method, which will incur additional charges.

## Four Acid Digestion Individual Elements

A selection of individual elements is offered to enable suites to be customised to suit your specific needs, or where only a few elements are required.

### Four Acid ICP-OES Individual Elements

Element	Range ppm		Element	Range ppm		Element	Range ppm	
Ag	0.5	- 500	Fe	100	- 50%	S	50	- 10%
Al	50	- 15%	K	20	- 10%	Sb	5	- 1%
As	10	- 1%	La	5	- 5000	Sc	1	- 5000
Ba	2	- 5000	Li	1	- 5000	Sn	20	- 2000
Bi	5	- 1%	Mg	20	- 40%	Sr	1	- 1%
Ca	50	- 40%	Mn	1	- 2%	Te	20	- 2000
Cd	0.5	- 2000	Mo	5	- 1%	Ti	5	- 2%
Ce	20	- 1%	Na	20	- 10%	Tl	10	- 2000
Co	1	- 1%	Ni	1	- 2%	V	1	- 5000
Cr	5	- 2%	P	50	- 5%	W	20	- 2000
Cu	1	- 2%	Pb	5	- 1%	Zn	1	- 2%
Nb	20	- 2000	Se	20	- 2000	Zr	2	- 2000

#### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

## Four Acid ICP-MS Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.05 - 500	Ge	0.05 - 2000	Se	0.5 - 1%
Al	10 - 1%	Hf	0.05 - 2000	Sm	0.01 - 5000
As	0.5 - 2000	Ho	0.01 - 2000	Sn	0.1 - 2000
Ba	0.1 - 2000	In	0.005 - 2000	Sr	0.05 - 2000
Be	0.05 - 2000	La	0.01 - 5000	Ta	0.01 - 2000
Bi	0.01 - 500	Li	0.1 - 1000	Tb	0.005 - 2000
Ca	20 - 1%	Lu	0.005 - 2000	Te	0.05 - 2000
Cd	0.02 - 500	Mg	20 - 1%	Th	0.01 - 5000
Ce	0.01 - 5000	Mn	1 - 1%	Ti	5 - 5000
Co	0.1 - 2000	Mo	0.1 - 1000	Tl	0.02 - 500
Cu	0.5 - 5000	Nb	0.05 - 2000	Tm	0.01 - 2000
Cr	0.5 - 5000	Nd	0.01 - 5000	U	0.01 - 1%
Cs	0.05 - 2000	Ni	0.5 - 5000	V	1 - 2000
Dy	0.01 - 2000	Pb	0.5 - 2000	W	0.1 - 500
Er	0.01 - 2000	Pr	0.005 - 5000	Y	0.05 - 2000
Eu	0.01 - 2000	Rb	0.05 - 2000	Yb	0.01 - 2000
Fe	20 - 1%	Re	0.002 - 2000	Zn	1 - 5000
Ga	0.05 - 2000	Sb	0.05 - 500	Zr	0.1 - 2000
Gd	0.01 - 2000	Sc	0.1 - 5000		

## Four Acid AAS Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 500	Cr	10 - 2%	Mo	10 - 1%
As	100 - 2%	Cu	10 - 5%	Ni	10 - 5%
Bi	10 - 1%	Fe	100 - 50%	Pb	10 - 1%
Ca	100 - 40%	Mg	10 - 40%	Sb	100 - 1%
Cd	10 - 2000	Mn	10 - 5%	Zn	1 - 5%
Co	10 - 1%				

Description	Code	Price
4 Acid digestion / ICP first element		₱742.50
4 Acid digestion / secondary instrument first element	4A/OM	₱380.50
4 Acid digestion / per additional ICP element		₱37.00
4 acid digestion / AAS first element		₱630.00
4 acid digestion / per additional AAS element	4A/AA	₱65.50

## Four Acid AAS Individual Elements

Element	Range ppm	Element	Range ppm
As	1 - 100	Sb	1 - 100
4 acid digestion / Hydride AAS per element		4A/AAH	₱214.00

## Individual Elements by Hydride AAS

Element	Range ppm	Element	Range ppm
As	1 - 100	Sb	1 - 100
4 acid digestion / Hydride AAS per element		4A/AAH	₱214.00

## Trace Elements by Pressed Powder XRF

Pressed powder XRF is a useful technique for the rapid analysis of trace to minor quantities of single elements using quick matrix correction that ensures high daily throughput and fast turnaround. The pulverised sample is mixed with a binder and pressed into a briquette which removes the need for digestion and facilitates the analysis of elements present in refractory minerals. Control of grinding parameters reduces errors due to particle size and mineralogical effects. The pressed powder method is suitable for light matrices. Samples may be diluted with silica to expand the range and reduce matrix effects.

Element	Range ppm	Element	Range ppm
As	1 - 1%	Mo	1 - 1%

Description	Code	Price
Pressed powder	/ XRF including first element / per additional element	PP/XRF101 ₹95.50
Over range elements	/dilution including first element / per additional element	PP/XRF102 ₹95.50

Elements where the concentration exceeds the upper limit will be determined by dilution and re-read or alternatively by an appropriate analytical method. Either option will incur additional costs.

### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

# Ores & Commodities

A diverse suite of procedures provide optimum precision and accuracy of the target element typically required in advanced exploration and resource evaluation. Techniques include multi-acid and fusion digests, useful for characterisation of geological samples where total dissolution of the sample is required, coupled with ICP-OES, ICP-MS and XRF instrumentation.

The most commonly used analytical procedures are listed, however this is not an exhaustive list and we encourage you to contact your local manager to discuss your specific requirements. Not all methods and packages listed are available at all locations.

Trade commercial grade sample analysis where results are used for umpire or commercial settlement are available on request, see the Minerals Trade Services section on page 52.



# Ores and High Grade Materials

## Four Acid Digestion

High grade sulphide ores are readily quantified using a 4 acid digest formulated to retain low-solubility elements such as Pb and Ag in solution at higher concentrations. This is a near total dissolution however elements incorporated in high refractory minerals may not be completely digested.

### Four Acid Ore Grade ICP-OES Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	10 - 1%	K	200 - 20%	S	500 - 60%
Al	500 - 50%	Li	20 - 10%	Sb	100 - 10%
As	100 - 20%	Mg	500 - 60%	Sc	10 - 2%
Bi	20 - 5%	Mn	20 - 50%	Sr	20 - 5%
Ca	500 - 50%	Mo	20 - 10%	Te	100 - 5%
Cd	20 - 50%	Na	500 - 20%	Ti	20 - 5%
Co	20 - 20%	Ni	20 - 70%	Tl	100 - 5%
Cu	20 - 70%	P	500 - 50%	V	20 - 5%
Fe	1000 - 70%	Pb	100 - 10%	Zn	10 - 70%
Ore grade 4 acid digest / ICP-OES			4AH1/OE101	₱1176.50	

### Four Acid Ore Grade ICP-OES Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	10 - 1%	K	200 - 20%	S	500 - 60%
Al	500 - 50%	Li	20 - 10%	Sb	100 - 10%
As	100 - 20%	Mg	500 - 60%	Sc	10 - 2%
Bi	20 - 5%	Mn	20 - 50%	Sr	20 - 5%
Ca	500 - 50%	Mo	20 - 10%	Te	100 - 5%
Cd	20 - 50%	Na	500 - 20%	Ti	20 - 5%
Co	20 - 20%	Ni	20 - 70%	Tl	100 - 5%
Cu	20 - 70%	P	500 - 50%	V	20 - 5%
Fe	1000 - 70%	Pb	100 - 10%	Zn	10 - 70%

Description	Code	Price
Ore grade 4 acid digest / ICP-OES first element	4AH1/OM1	₱832.00
/ per additional element		₱37.00

### Four Acid Ore Grade AAS Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	5 - 1%	Co	100 - 40%	Mo	100 - 20%
As	500 - 20%	Cu	100 - 50%	Ni	100 - 50%
Bi	100 - 10%	Fe	200 - 70%	Pb	100 - 20%
Cd	100 - 40%	Mn	100 - 60%	Zn	100 - 60%

Description	Code	Price
Ore grade 4 acid digest / AAS first element	4AH1/AA	₱665.50
/ per additional element		₱65.50

### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

## Fusion Decomposition

Two principal fusion methods are offered, lithium borate fusions in platinum crucibles and sodium peroxide fusions in either nickel or zirconium crucibles. Fusion methods digest all major rock forming minerals, including many that resist acid digestion. Once dissolved, the fusion product can be analysed by either ICP-OES or ICP-MS. Borate fusions are suitable for quantification of the major oxide components of geological samples and many trace elements. Peroxide fusions are more robust than borate fusions and are used routinely with sulphide ores. Sodium, the crucible element and a small suite of other elements are not available with peroxide fusions.

Specific commodity packages are found from page 25.

### Lithium Borate Fusion

Lithium borate fusion offers a high temperature aggressive digest suitable for almost all geological samples. The technique is optimised for accuracy at both high and low element concentrations. Major element analysis can be carried out with either ICP or XRF finishes. The whole rock packages are available on Pg 32 and can be coupled with selected minor and trace elements listed below. Results for Co and Mo, are semi quantitative only by this fusion method.

Samples containing high sulphides (2%), elevated copper (1%) and other reduced species such as metallics, arsenides, carbides and carbon should be analysed using the sodium peroxide fusion options. Specialised methods on page 30 should be utilised where the REE oxide content exceeds 1%.

### Lithium Borate Individual Elements by ICP-OES / ICP-MS

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish	
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100%	ICP-OES	Ho	0.1 - 2%	ICP-MS	SiO <sub>2</sub>	0.01% - 100%	ICP-OES	
Ba	0.5 - 5%	ICP-MS	K <sub>2</sub> O	0.01% - 100%	ICP-OES	Sm	0.1 - 10%	ICP-MS	
Be	0.5 - 2%	ICP-MS	La	0.2 - 20%	ICP-MS	Sn	1 - 5%	ICP-MS	
CaO	0.01% - 100%	ICP-OES	Lu	0.1 - 1%	ICP-MS	Sr	0.2 - 20%	ICP-MS	
Ce	0.5 - 30%	ICP-MS	MgO	0.01% - 100%	ICP-OES	Ta	0.1 - 5%	ICP-MS	
Co	0.5 - 10%	ICP-MS	MnO	0.01% - 100%	ICP-OES	Tb	0.1 - 2%	ICP-MS	
Cr	20 - 5%	ICP-OES	Mo	1 - 1%	ICP-MS	Th	0.1 - 2%	ICP-MS	
Cs	0.1 - 1%	ICP-MS	Na <sub>2</sub> O	0.01% - 100%	ICP-OES	TiO <sub>2</sub>	0.01% - 100%	ICP-OES	
Dy	0.1 - 5%	ICP-MS	Nb	0.1 - 5%	ICP-MS	Tm	0.1 - 1%	ICP-MS	
Er	0.1 - 5%	ICP-MS	Nd	0.1 - 20%	ICP-MS	U	0.1 - 30%	ICP-MS	
Eu	0.1 - 5%	ICP-MS	P <sub>2</sub> O <sub>5</sub>	0.01% - 100%	ICP-OES	V	10 - 5%	ICP-OES	
Fe <sub>2</sub> O <sub>3</sub>	0.01% - 100%	ICP-OES	Pr	0.1 - 10%	ICP-MS	W	1 - 5%	ICP-MS	
Ga	0.5 - 5%	ICP-MS	Rb	0.1 - 5%	ICP-MS	Y	0.5 - 50%	ICP-MS	
Gd	0.1 - 5%	ICP-MS	Sb	0.5 - 2%	ICP-MS	Yb	0.1 - 5%	ICP-MS	
Hf	0.1 - 5%	ICP-MS	Sc	10 - 5%	ICP-OES	Zr	1 - 50%	ICP-MS	
Lithium borate fusion/ ICP first element					FB6/OM		P1604.00		
/ secondary instrument first element							P594.00		
/ per additional element							P53.50		

## Sodium Peroxide Fusions

Sodium peroxide fusions offer total dissolution of the sample and can be performed in either nickel or zirconium crucibles to preclude the presence of unwanted contaminant metals thus allowing different element suites to be tailored for various purposes. Sodium peroxide fusions are useful for samples in which the elements of interest are hosted in minerals that may resist acid digestions. These include, amongst others, minerals and ores containing rare earth elements (REE) and the high field strength elements (HFSE), Sn, W, Ti, Ta, Nb and V.

### Zirconium Crucible Fusion Individual Elements by ICP-OES & ICP-MS Suitable for Majors, Boron and Base Metals

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Al	100 - 50%	ICP-OES	In	0.1 - 5%	ICP-MS	Si	0.1% - 50%	ICP-OES
As	20 - 20%	ICP-MS	K	500 - 20%	ICP-OES	Sn	100 - 50%	ICP-MS
B	50 - 10%	ICP-OES	Li	1 - 20%	ICP-MS	Sr	20 - 20%	ICP-MS
Ba	1 - 2%	ICP-MS	Mg	100 - 60%	ICP-OES	Ta	0.1 - 50%	ICP-MS
Be	1 - 2%	ICP-MS	Mn	20 - 75%	ICP-OES	Te	2 - 2%	ICP-MS
Bi	0.1 - 10%	ICP-MS	Mo	1 - 10%	ICP-MS	Th	0.1 - 2%	ICP-MS
Ca	0.1% - 70%	ICP-OES	Nb	2 - 30%	ICP-MS	Ti	100 - 60%	ICP-OES
Cd	10 - 5%	ICP-MS	Ni	20 - 70%	ICP-OES	Tl	0.5 - 2%	ICP-MS
Co	1 - 20%	ICP-MS	Pb	20 - 70%	ICP-MS	U	0.1 - 60%	ICP-MS
Cr	50 - 40%	ICP-OES	Rb	0.5 - 5%	ICP-MS	V	20 - 20%	ICP-OES
Cs	0.1 - 1%	ICP-MS	Re	0.1 - 1%	ICP-MS	W	1 - 50%	ICP-MS
Cu	20 - 70%	ICP-OES	S	500 - 60%	ICP-OES	Y	0.5 - 50%	ICP-MS
Fe	100 - 75%	ICP-OES	Sb	0.5 - 10%	ICP-MS	Zn	20 - 70%	ICP-OES
Ga	1 - 5%	ICP-MS	Sc	10 - 5%	ICP-OES			
Ge	1 - 0.1%	ICP-MS	Se	20 - 2%	ICP-MS			
Sodium peroxide fusion Zr crucible / ICP first element / secondary instrument first element / per additional element						FP1/OM		₱1123.00 ₱594.00 ₱53.50

### Nickel Crucible Fusion ICP-OES & ICP-MS Individual Elements Suitable for Majors and Boron

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Al	100 - 50%	ICP-OES	Ho	0.1 - 2%	ICP-MS	Si	0.1% - 50%	ICP-OES
Ag	5 - 2%	ICP-MS	In	0.1 - 5%	ICP-MS	Sm	0.1 - 10%	ICP-MS
As	20 - 20%	ICP-MS	K	500 - 20%	ICP-OES	Sn	2 - 50%	ICP-MS
B	50 - 10%	ICP-OES	La	0.2 - 20%	ICP-MS	Sr	20 - 20%	ICP-MS
Ba	1 - 2%	ICP-MS	Li	5 - 20%	ICP-MS	Ta	0.1 - 50%	ICP-MS
Be	1 - 2%	ICP-MS	Lu	0.1 - 1%	ICP-MS	Tb	0.1 - 2%	ICP-MS
Bi	0.1 - 10%	ICP-MS	Mg	100 - 60%	ICP-OES	Te	1 - 2%	ICP-MS
Ca	0.1% - 70%	ICP-OES	Mn	0.2% - 75%	ICP-OES	Th	0.1 - 2%	ICP-MS
Cd	1 - 5%	ICP-MS	Nb	10 - 30%	ICP-MS	Ti	500 - 60%	ICP-OES
Ce	0.5 - 30%	ICP-MS	Nd	0.1 - 20%	ICP-MS	Tl	0.5 - 2%	ICP-MS
Cr	500 - 40%	ICP-OES	P	100 - 50%	ICP-OES	Tm	0.1 - 1%	ICP-MS
Cs	0.1 - 1%	ICP-MS	Pb	20 - 70%	ICP-OES	U	0.1 - 60%	ICP-MS
Dy	0.1 - 5%	ICP-MS	Pr	0.1 - 10%	ICP-MS	V	50 - 20%	ICP-OES
Er	0.1 - 5%	ICP-MS	Rb	0.5 - 5%	ICP-MS	W	1 - 50%	ICP-MS
Eu	0.1 - 5%	ICP-MS	Re	0.1 - 1%	ICP-MS	Y	0.5 - 50%	ICP-MS
Fe	100 - 75%	ICP-OES	S	500 - 60%	ICP-MS	Yb	0.1 - 5%	ICP-MS
Ga	1 - 5%	ICP-MS	Sb	0.5 - 10%	ICP-OES	Zr	5 - 50%	ICP-MS
Gd	0.1 - 5%	ICP-MS	Sc	10 - 5%	ICP-MS			
Hf	0.1 - 5%	ICP-MS	Se	20 - 2%	ICP-MS			
Sodium peroxide fusion Ni crucible / ICP first element / secondary instrument first element / per additional element						FP6/OM		₱1123.00 ₱594.00 ₱53.50

#### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

## Specific Commodities

### Iron Ore

X-ray fluorescence spectroscopy (XRF) is the preferred method of analysis for iron ore samples. Accuracy, long term reproducibility and high throughput means XRF is unparalleled in the modern geochemical laboratory for the analysis of the major components of iron ores.

Pulverised samples are fused with a lithium borate flux and cast into disks using semi or fully automated technology. The use of fusion disks eliminates physical effects such as particle size and reduces matrix effects which can compromise the accuracy of XRF analysis. High quality data is produced using either simultaneous or sequential wavelength dispersive instrumentation.

Loss on ignition (LOI) is determined by the use of thermo gravimetric analysis (TGA). Single point LOI is determined at 1000°C and is included in the iron ore packages. Customised multiple point LOI determinations are available on request.

#### Basic Iron Ore XRF Package

Suitable for exploration and resource modeling this suite is intended to quantify the essential major and minor oxide components of an iron ore sample.

Element	Range %	Element	Range %	Element	Range %
Fe	0.01 - 75	MgO	0.01 - 100	SiO <sub>2</sub>	0.01 - 100
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	MnO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
CaO	0.01 - 100	Na <sub>2</sub> O	0.01 - 100	V <sub>2</sub> O <sub>5</sub>	0.005 - 10
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 10	P <sub>2</sub> O <sub>5</sub>	0.001 - 45	LOI 1000°C	0.01 - 100
K <sub>2</sub> O	0.01 - 100	SO <sub>3</sub>	0.001 - 40		
Li borate fusion / XRF			FB1/XRF10	₱1712.50	

#### Iron Ore XRF Extended Suite Package

Suitable for exploration and resource modelling as well as quantification of additional accessory and deleterious elements. These elements are less abundant in most iron ores however, they may affect the quality of the ore if present in significant quantities.

#### Iron Ore Extended Suite - Standard Detection Limits XRF Package

Element	Range %	Element	Range %	Element	Range %
Fe	0.01 - 75	K <sub>2</sub> O	0.01 - 100	Sn	0.005 - 5
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	MgO	0.01 - 100	Sr	0.005 - 5
As	0.005 - 5	MnO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
BaO	0.005 - 5	Na <sub>2</sub> O	0.01 - 100	V <sub>2</sub> O <sub>5</sub>	0.005 - 10
CaO	0.01 - 100	Ni	0.005 - 20	Zn	0.005 - 5
Cl	0.005 - 5	P <sub>2</sub> O <sub>5</sub>	0.001 - 45	Zr	0.005 - 5
Co	0.005 - 5	Pb	0.005 - 5	LOI 1000°C	0.01 - 100
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 10	SO <sub>3</sub>	0.001 - 40		
Cu	0.005 - 5	SiO <sub>2</sub>	0.01 - 100		
Li borate fusion / XRF			FB1/XRF11	₱2033.00	

### Aluminium Ore (Bauxite)

XRF analysis of bauxite is the preferred method to return total values of the component oxides such as alumina and silica. A single point LOI is done at 1000°C. As bauxites are highly hygroscopic, all data is corrected to the dry sample.

Of more fundamental importance are the available alumina and reactive silica components of the bauxite ores. The available alumina is the alumina component that can be extracted using the sodium hydroxide leaching Bayer process. The reactive silica is the silica component that dissolves in the Bayer process and reacts with some of the dissolved alumina and sodium hydroxide, whereby both alumina and sodium are lost to the process. Reactive silica and available alumina are determined in the Perth dedicated bauxite analysis facility.

#### Bauxite XRF Package

Element	Range %	Element	Range %	Element	Range %
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	MgO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
BaO	0.01 - 100	MnO	0.01 - 100	V <sub>2</sub> O <sub>5</sub>	0.005 - 100
CaO	0.01 - 100	Na <sub>2</sub> O	0.01 - 100	ZrO <sub>2</sub>	0.01 - 100
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 100	P <sub>2</sub> O <sub>5</sub>	0.002 - 100	LOI 1000°C	0.01 - 100
Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	SiO <sub>2</sub>	0.01 - 100		
K <sub>2</sub> O	0.01 - 100	SO <sub>3</sub>	0.002 - 100		
Li borate fusion / XRF			FB1/XRF30	₱1712.50	

## Chromium Ore

Chromium ores are usually found associated with ultramafic rocks and may be accurately analysed by fusion XRF with a single point LOI (1000°C). The highly refractory nature of chromite ores requires a specialist approach in the fusion process to ensure that the spinel structure is decomposed and the entire sample is dissolved in the fusion disk. The LOI is usually negative in higher grade ores due to the oxidation of ferrous iron in the spinel structure. The major element analysis can be used to classify the chromite ore.

### Chromite Ore XRF Package

Element	Range %	Element	Range %	Element	Range %
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 100	MgO	0.01 - 50	SO <sub>3</sub>	0.002 - 10
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	MnO	0.005 - 10	TiO <sub>2</sub>	0.01 - 10
CaO	0.01 - 100	Na <sub>2</sub> O	0.01 - 10	V <sub>2</sub> O <sub>5</sub>	0.002 - 10
Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	P <sub>2</sub> O <sub>5</sub>	0.001 - 10	LOI 1000°C	
K <sub>2</sub> O	0.01 - 100	SiO <sub>2</sub>	0.01 - 50		
Li borate fusion / XRF			FB1/XRF35	P1922.00	

## Nickel Laterite Ores

The oxidised nature of nickel laterite ore and the low sulphur contents make XRF with a single point LOI an ideal technique for the chemical characterisation of these ores. XRF can accurately quantify the nickel and cobalt contents of the ore, important trace elements such as cobalt and zinc, as well as the major oxide components which are used to classify the laterite ore type. Nickel laterite ores can be hygroscopic with high moisture contents. Moisture is therefore corrected for routinely and all results are reported on a dry basis.

### Nickel Laterite Ore XRF Package

Element	Range %	Element	Range %	Element	Range %
Ni	0.005 - 20	Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	P <sub>2</sub> O <sub>5</sub>	0.002 - 100
Co	0.005 - 5	K <sub>2</sub> O	0.01 - 100	SiO <sub>2</sub>	0.01 - 100
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	MgO	0.01 - 100	SO <sub>3</sub>	0.002 - 100
CaO	0.01 - 100	MnO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 100	Na <sub>2</sub> O	0.01 - 100	LOI 1000°C	0.01 - 100
Li borate fusion / XRF			FB1/XRF40	P1712.50	

### Nickel Laterite Ore XRF Extended Suite Package

Suitable for exploration and resource modelling as well as quantification of additional accessory and deleterious elements. These elements are less abundant in most iron ores however, they may affect the quality of the ore if present in significant quantities.

### Nickel Laterite Extended Suite - Standard Detection Limits XRF Package

Element	Range %	Element	Range %	Element	Range %
Ni	0.005 - 20	Cu	0.005 - 5	SO <sub>3</sub>	0.001 - 40
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	K <sub>2</sub> O	0.01 - 100	SiO <sub>2</sub>	0.01 - 100
As	0.005 - 5	MgO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
BaO	0.005 - 5	MnO	0.01 - 100	V <sub>2</sub> O <sub>5</sub>	0.005 - 10
CaO	0.01 - 100	Na <sub>2</sub> O	0.01 - 100	Zn	0.005 - 5
Cl	0.005 - 5	Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	LOI 1000°C	0.01 - 100
Co	0.005 - 5	P <sub>2</sub> O <sub>5</sub>	0.001 - 45		
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 10	Pb	0.005 - 5		
Li borate fusion / XRF			FB1/XRF141	P2033.00	

### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

## Manganese Ore

XRF, with a single point LOI (1000°C), is routinely used in the accurate quantification of the chemical components of manganese ores. A complete oxide suite is analysed which includes Pb and Ba. These two elements can be important components of the ore and the concentrations of these elements are required to do the requisite matrix corrections in the XRF analysis.

### Manganese Ore XRF Package

Element	Range %	Element	Range %	Element	Range %
MnO	0.005 - 100	Fe <sub>2</sub> O <sub>3</sub>	0.01 - 50	SiO <sub>2</sub>	0.01 - 80
Al <sub>2</sub> O <sub>3</sub>	0.01 - 50	K <sub>2</sub> O	0.01 - 20	SO <sub>3</sub>	0.002 - 10
BaO	0.005 - 5	MgO	0.01 - 20	TiO <sub>2</sub>	0.01 - 10
CaO	0.01 - 50	Na <sub>2</sub> O	0.01 - 20	V <sub>2</sub> O <sub>5</sub>	0.002 - 10
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 20	P <sub>2</sub> O <sub>5</sub>	0.001 - 10	Zn	0.002 - 5
Cu	0.002 - 5	Pb	0.002 - 5	LOI 1000°C	
Li borate fusion / XRF			FB1/XRF125	₱1712.50	

## Limestones & Dolomites

XRF is a very useful technique for the analysis of diverse rock types and is the favored routine method for the full chemical characterisation of assorted industrial mineral feedstocks and products such as attapulgite, kaolinite, pyrophyllite, limestone, dolomite, phosphates, cement, mica and feldspar.

### Limestone & Dolomite XRF Package - suitable for samples containing <500ppm uranium.

Element	Range ppm	Element	Range ppm	Element	Range ppm
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	MgO	0.01 - 100	SO <sub>3</sub>	0.002 - 100
CaO	0.01 - 100	MnO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
Cr <sub>2</sub> O <sub>3</sub>	0.01 - 100	Na <sub>2</sub> O	0.01 - 100	LOI 1000°C	0.01 - 100
Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	P <sub>2</sub> O <sub>5</sub>	0.002 - 100		
K <sub>2</sub> O	0.01 - 100	SiO <sub>2</sub>	0.01 - 100		
Li borate fusion / XRF			FB3/XRF60	₱1712.50	

## Rare Earth Elements

The refractory nature of many of the minerals which host rare earth elements (REE) make fusion followed by ICP-MS an ideal technique for the accurate characterisation of REE ores along with important major, minor and trace components. The fusion approach ensures the complete digestion of all minerals giving total elemental analyses. All data is checked for consistency using chondrite normalised plots.

### REE Mineralisation Na Peroxide Fusion ICP-MS Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
La	0.2 - 20%	Ho	0.1 - 2%	Ta	0.1 - 50%
Ce	0.5 - 30%	Er	0.1 - 5%	Hf	0.1 - 5%
Pr	0.05 - 10%	Tm	0.05 - 1%	Zr	5 - 50%
Nd	0.1 - 20%	Yb	0.1 - 5%	Sn	2 - 50%
Sm	0.1 - 10%	Lu	0.05 - 1%	W	1 - 50%
Eu	0.1 - %	Y	0.5 - 50%	Li	1 - 20%
Gd	0.1 - 5%	Th	0.1 - 2%	Be	1 - 2%
Tb	0.05 - 2%	U	0.1 - 60%	Ga	1 - 5%
Dy	0.1 - 5%	Nb	10 - 30%		
REE	Sodium peroxide fusion Ni crucible / ICP-MS			FP6/MS33	₱2222.00

## Copper

A spectrum of analytical techniques are offered that add value to the copper industry supply chain. These include ultra-sensitive exploration methods, ore grade characterization and empirical digestion techniques that target copper in different forms. Acid soluble copper refers to the metal content extractable using dilute sulphuric acid. This includes the most common oxide copper species malachite, azurite and chrysocolla. Other copper minerals may also be partially dissolved. Cyanide soluble copper includes most oxide minerals, common sulphide minerals but not chalcopyrite. These techniques are empirical in that the recovery depends on the conditions of the digest, the degree of comminution and the deportment of the metal in the ore. Total copper is offered by four acid digest. Umpire and commercial exchange assay services are available at Interteks specialist LSI laboratory, see Minerals Trade Services.

## Specialised and Classical Methods

### Copper Speciation

Analyte	Description	Code	Price
Cu_A	Acid soluble Cu - Dilute H <sub>2</sub> SO <sub>4</sub> leach / AAS	CUA/AA	₱475.50
Cu_CN	Cyanide soluble Cu - Ambient temperature cyanide leach / AAS	CUCN/AA	₱570.50
Cu_Res	Residual Copper Residual copper after sequential leach	4A/AA	₱630.00
Cu_A2	Acetic Acid Soluble Cu	CUA2/AA	₱475.50
The cyanide soluble copper analysis can be performed as a standalone determination or sequential to the acid soluble Cu method. Copper Speciation Package (Cu_A + Cu_CN + Cu_Res) -			CUSEQ ₱1237.50

### Classical Methods

Analyte	Description	Code	Price
Fe	Volumetric analysis of Fe in Iron Ore	FE1/VOL	₱3564.00
Fe	Volumetric analysis of Fe in Chromite Ores	FE2/VOL	₱3564.00
FeO	Acid Digestion/ Titration	AD71/VOL	₱4158.00
Cu	Cu ores & concentrates by short iodide	CU1/VOL	₱3564.00
Cu	Cu ores & concentrates by long iodide	CU2/VOL	₱4158.00
Cr	Volumetric analysis of Cr in Chromite Ores	CR1/VOL	₱3564.00
Si	Gravimetric analysis of Si in general rocks/soils	SI1/GR	₱3326.50
Si	Gravimetric analysis of Si in Chromite Ores	SI2/GR	₱3326.50
Si	Gravimetric analysis of Si in Manganese Ores	SI3/GR	₱3326.50
Si	Gravimetric analysis of Si in Si Sands	SI4/GR	₱3326.50
S	Gravimetric analysis of S	S1/GR	₱2376.00
P	Volumetric analysis of total P	P1/VOL	₱3564.00
Mn	Volumetric analysis of Manganese Ores and concentrates	MN1/VOL	₱3564.00
Ca	Volumetric analysis of Ca	CA1/VOL	₱3564.00
CaO	Volumetric analysis of CaO available lime	CAO/VOL	₱2138.50

## Lithium

Lithium is a lithophile element that occurs predominantly in silicate minerals where it is diadochic with potassium, sodium, iron and magnesium. Sources of lithium include brines, certain granite pegmatites in the minerals spodumene, petalite and lepidolite and clays, hectorite, in particular.

Lithium minerals are easily soluble in 4 acid digests and are also amenable to decomposition using fusion digests. Whereas 4 acid digests may be suitable for simple silicate-hosted lithium assays, lithium minerals in pegmatites may be associated with other important economic minerals such as columbite-tantalite, wolframite and cassiterite which require fusion decomposition to quantify accurately.

Intertek has extensive experience with lithium analysis in pegmatites, alkaline rocks and brine solutions as well as almost all common geological materials including vegetation. For analysis of lithium bearing lithologies that contain significant quantities of Sn, Ta, Nb a fusion digest is recommended to accurately quantify these refractory elements.

### 48 Element Lithium Exploration Package

Element	Range ppm		Element	Range ppm		Element	Range ppm	
Li	0.1	- 5000	Ge	0.1	- 2000	Sb	0.05	- 1%
Ag	0.05	- 500	Hf	0.05	- 2000	Sc	0.1	- 5000
Al	50	- 15%	In	0.01	- 2000	Se	0.5	- 1%
As	0.5	- 1%	K	20	- 10%	Sn	0.1	- 2000
Ba	0.1	- 5000	La	0.01	- 5000	Sr	0.05	- 1%
Be	0.05	- 2000	Mg	20	- 40%	Ta	0.01	- 2000
Bi	0.01	- 1%	Mn	1	- 5%	Te	0.2	- 2000
Ca	50	- 40%	Mo	0.1	- 1%	Th	0.01	- 5000
Cd	0.02	- 2000	Na	20	- 10%	Ti	5	- 2%
Ce	0.01	- 1%	Nb	0.05	- 2000	Tl	0.02	- 2000
Co	0.1	- 2%	Ni	0.5	- 2%	U	0.01	- 1%
Cr	1	- 2%	P	50	- 5%	V	1	- 2%
Cs	0.05	- 2000	Pb	0.5	- 1%	W	0.1	- 2000
Cu	0.5	- 2%	Rb	0.05	- 2000	Y	0.05	- 2000
Fe	100	- 50%	Re	0.002	- 2000	Zn	1	- 2%
Ga	0.05	- 2000	S	500	- 10%	Zr	0.1	- 2000
Lithium 4 acid digestion/ ICP-MS package				4A-Li/MS48		POA		

### Zirconium Crucible Fusion ICP-MS Individual Element

Element	Description	Range	Code	Price
Li	Sodium peroxide fusion Zr Crucible	1 - 20%	FP1-Li/MS	POA

#### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

# Individual Methods



### Gravimetric Determinations

Element	Description	Detection Limit	Code	Price
Bulk Density	Bulk Density in a Measuring Cylinder	0.01g/cm <sub>3</sub>	BD101/GR	₱490.00
Magnetic Separation	Davis Tube Recovery on fine product, <75µm, 100g sample	0.01%	DTR101/GR	₱678.00
LOD	Loss on drying (105°C or client nominated temperature)	0.01%	LOD/GR	₱119.00
LOD	Loss on drying (105°C or client nominated temperature) to constant weight	0.01%	LOD1/GR	₱267.50
LOI	Loss on ignition (1000°C or client nominated temperatures)	0.01%	LOI1/GR	₱267.50
SG	Specific gravity / pulp (Archimedes principle)		SGP/GR01	₱500.00
SG	Specific gravity / core and rocks uncoated		SG/GR	₱475.50
SG	Specific gravity / core and rocks wax coated		SGW/GR	₱861.50

### Carbon and Sulphur Analysis

Carbon and sulphur analyses using a variety of spectroscopic or gravimetric methods with the option of pretreatments for targeting specific forms of the analyte element.

Element	Description	Detection Limit	Code	Price
C	Total carbon by CS analyser	0.01% - 50%	CSA01	₱760.50
S	Total sulphur by CS analyser	0.01% - 50%	CSA02	₱760.50
C,S	Total carbon & sulfur by CS analyser	0.01% - 50%	CSA03	₱1140.50
S <sub>2</sub> *	Carbonate leach for estimation of sulfide sulfur	0.05% - 70%	CSA104	₱796.00
S <sub>4</sub> *	Carbonate extract for soluble sulfate /gravimetric	0.01% - 50%	S72/GR	₱2245.50
C non carbonate	Weak acid digestion/ CS analyser	0.01% - 50%	C71/CSA	₱1723.00

\*May not include all Ba, Sr and Pb sulphates

### Acid Rock Drainage Package

ARD screening methods are used in categorizing the relative acid forming potential of a sample. The following methods are conducted as per AMIRA 2002 guidelines.

Element	Description	Detection Limit	Code	Price
ANC	Titrimetric measurement of acid consumption	1kgH <sub>2</sub> SO <sub>4</sub> /t		
NAG	Titrimetric measurement of acid generation by oxidation, non-kinetic	1kgH <sub>2</sub> SO <sub>4</sub> /t		
NAG pH	pH of oxidised solution	0.1		
S	S by acid digestion ICP-OES	0.01%	ARD102	POA
pH	Paste pH of 1:2 water extract	0.1		
NAPP	Net acid producing potential calculated from ANC and S	1kgH <sub>2</sub> SO <sub>4</sub> /t		
MPA	Maximum potential acidity calculated from S	1kgH <sub>2</sub> SO <sub>4</sub> /t		

Follow up testing to obtain more information on acid forming capacities and resolve samples with uncertain classifications such as Sequential NAG, Kinetic NAG and free draining Leach Column Testing would also be available on a project basis.

The most commonly used analytical procedures are listed, however this is not an exhaustive list and we encourage you to contact your local manager to discuss your specific requirements. Not all methods and packages listed are available at all locations.

# Analysis of Naturally Occurring Water

Detection limits and prices apply to naturally occurring waters with an electrical conductivity (EC) of less than 1000mS/Cm. More saline or highly mineralised solutions will require dilution and detection limits will be increased. Upper limits may apply to some elements, especially by ICP-MS.

Correct sampling and preservation of samples is critical. Preparation charges may apply. Please contact the laboratory for detailed instructions.

## Waters ICP-OES Individual Elements

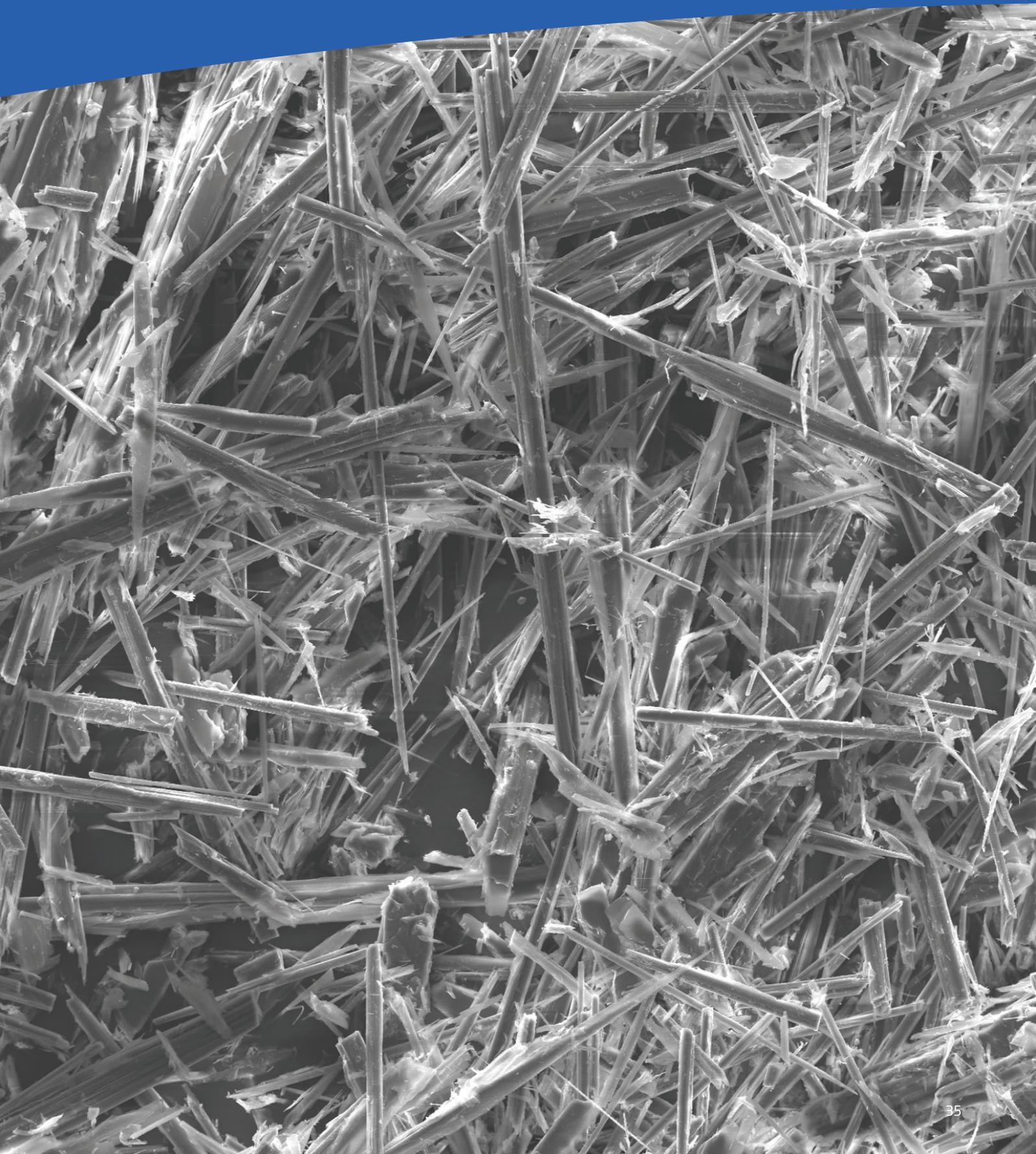
Element	DL mg	Element	DL mg	Element	DL mg
Ag	0.01	Fe	0.01	S	0.1
Al	0.01	K	0.1	Sc	0.01
As	0.02	Li	0.1	Si	0.05
B	0.01	Mg	0.01	Sr	0.01
Ba	0.01	Mn	0.01	Ti	0.01
Ca	0.01	Mo	0.01	V	0.01
Cd	0.01	Na	0.1	Zn	0.01
Co	0.01	Ni	0.01	Zr	0.01
Cr	0.01	P	0.1		
Cu	0.01	Pb	0.02		

## Waters ICP-MS Individual Element

Element	DL µg	Element	DL µg	Element	DL µg
Ag	0.05	Hg	0.1	Se	0.2
As	0.05	Ho	0.01	Sm	0.01
Au	0.01	In	0.01	Sn	0.1
Ba	0.02	La	0.01	Sr	0.01
Be	0.05	Li	0.5	Ta	0.05
Bi	0.01	Lu	0.01	Tb	0.01
Cd	0.02	Mn	0.1	Te	0.1
Ce	0.01	Mo	0.05	Th	0.01
Co	0.05	Nb	0.02	Tl	0.01
Cs	0.01	Nd	0.01	Tm	0.01
Cu	0.1	Ni	0.1	U	0.005
Dy	0.01	Pb	0.1	V	1
Er	0.01	Pd	0.02	W	0.05
Eu	0.01	Pr	0.01	Y	0.01
Fe	1	Pt	0.02	Yb	0.01
Ga	0.01	Rb	0.01	Zn	0.2
Gd	0.01	Re	0.01	Zr	0.05
Ge	0.05	Ru	0.01		
Hf	0.01	Sb	0.05		

/ ICP first element	WAT/OE, WAT/MS (dissolved)	₱1069.50
/ first element secondary instrument		₱832.00
/ per additional element		₱71.50
/ ICP first element	WAT2/OE, WAT2/MS (total dissolved with acid digestion)	₱1176.50
/ first element secondary instrument		₱915.00
/ per additional element		₱78.50

# | Mineralogy



# Mineralogy

Applied mineralogy is the study of the mineral phases of materials which contrasts with and complements a traditional chemical analysis. Applied mineralogy identifies the nature of the mineral phase, the grain size and morphology, textures, mineral associations and other parameters. Applied mineralogy has important applications in mineral exploration, mineral processing, mineral waste disposal and treatment, hydrometallurgy, pyrometallurgy and refining. It is also utilised in the oil and gas, coal and environmental industries.

Various ores and commodities can be analysed such as base metal ores, precious metal ores, iron ores, bauxite, chromite, nickel, uranium, rare earths, industrial minerals (including graphite), refractory minerals and clays.

A comprehensive suite of applied mineralogy analyses are available, however not all services are available at all locations. Please call our Perth laboratory to discuss the options best suited to your requirements with Intertek's XRD specialist.

## Bulk Mineralogy

### X-Ray Diffraction

Powder X-ray diffraction (XRD) is an analytical technique primarily employed for the identification and quantification of crystalline materials in bulk samples, both natural and synthetic.

The results given are either qualitative (descriptive of the sample make-up) or quantitative. Quantitative results can include the non-crystalline (amorphous) content of the sample.

#### Sample Preparation

XRD Crush and Pulverize Package

Description	Code	Price
Crush -2mm, rotary split 800g, pulverise 800g to < 60µm	XRD13	POA

\*Samples are not to be dried

XRD Micronising Package

Description	Code	Price
Micronising	XRD14	POA

\*Samples are not to be dried

XRD Crush, Pulverize and Micronize Package

Description	Code	Price
Crush -2mm, rotary split 800g, pulverise 800g to <60µm, micronise	XRD15	POA

\*Samples are not to be dried

XRD Crush, Pulverize and Micronize Package

Description	Code	Price
Pulverise <800g to < 60µm, micronise	XRD16	POA

\*Samples are not to be dried

#### X-Ray Diffraction Analysis

A number of qualitative and quantitative options are available. Please contact the laboratory to discuss your specific requirements.

Element	Description	Code	Price
QUALITATIVE	Qualitative analysis for complete mineralogy	XRDQual	POA
QUANTITATIVE	Quantitative analysis for complete mineralogy and amorphous content	XRDQuant01	POA
QUANTITATIVE	Quantitative analysis for complete mineralogy and amorphous content (double scan analysis - not appropriate for some sample types)	XRDQuant02	POA

## Clay Mineralogy

Clays are important constituents of soils, mudstones, shales and some ores that often require specialist attention. A range of analytical tests are available, including:

- Clay separation from bulk materials
- Qualitative or quantitative XRD analysis from the bulk sample
- Clay mineral identification (XRD) (from glycolation and heating regimes)

### XRD Clay separation

Description	Code	Price
Separation of clay fraction, <2 µm	CLAYF	POA
Separation of clay fraction, <2 µm, in iron-rich samples	CLAYFFe	POA

### X-Ray Diffraction Analysis

Description	Code	Price	Price
QUALITATIVE	Qualitative analysis of clays (incl. glycolation and heating)	XRDQual01	POA

## Infra-Red Spectroscopy

### TerraSpec Near-Infrared Spectroscopy (NIR)

The TerraSpec 4 Hi Res spectrometer offers a rapid scan for the identification and characterisation of minerals visible in the NIR range. Minerals and mineral groups include haematite, goethite, garnet, pyroxene, amphibole, epidote, apatite, tourmaline, topaz, clay, mica, chlorite, serpentine, carbonates, hydrous silicates and rare earth minerals. The scan information can be used to identify, characterise and map alteration zones associated with various ore forming processes.

For best results, it is recommended that the characterisation of the mineral analysis be confirmed by XRD analysis on either a continuum or a selected subset of samples.

### ASD Terraspec Scan

Description	Code	Price
TerraSpec 4 Hi Res scan	NIR	POA
TSG Post processing mineralogy report - standard report (includes scan)	NIRO1	POA
aiSIRIS™ Post processing mineralogy report - standard report (includes scan)	NIRO3	POA

### Fourier-Transform Infrared Spectroscopy (FTIR)

Fourier-Transform Infrared Spectroscopy (FTIR) offers a rapid scan technique for the qualitative and quantitative analysis of organic and inorganic materials and minerals. Regression and calibration methods enable quantitative determination of mineralogy. This non-destructive technique requires minimal sample preparation.

Description	Code	Price
FTIR Scan	FTIR	POA
Quantitative determination	FTIRO2	POA

## Micro Mineralogy

### QEMSCAN

Automated mineralogy via QEMSCAN (Quantitative Evaluation of Minerals by Scanning Electron Microscopy) is used to identify mineral phases, in situ, at the micron scale on polished blocks or thin sections.

As well as identifying the minerals present, the processing of the data allows the visualisation of the textural and spatial arrangements of the minerals. The processing can thus determine grain sizes and shapes as well as provide information for mineral associations, mineral liberation, elemental deportment and elemental mapping.

The technique is best used in conjunction with the bulk mineralogical data obtained from XRD. Please contact us for options.

# Additional Information



## Sample Despatch

To assist with the efficient processing of your samples please email all assay instructions and any freight information prior to or at the time of despatch. Sample submissions received without written instructions cannot be processed until adequate written instructions are received from the client.

All discrepancies between submission sheets and actual samples received will be reported prior to commencement of the processing.

We recommend that all submissions of samples are clearly labelled and packaged in a concise and systematic order and are accompanied by accurate and detailed paperwork. To facilitate safe manual handling we would appreciate that samples be packaged in units not exceeding 25kg each. Sample submissions poorly labelled or packaged may incur additional sorting charges. Please "flag" the bag containing the paperwork.

Sample submission pads and pre-addressed stick-on labels are available upon request free of charge. A sample submission form is available from our web site. We offer an online submission service or the option to print a submission to be either emailed or faxed.

The minimum information required on any sample submission sheet is:

1. Client name
2. List or range of sample numbers
3. Sample preparation required
4. Elements required for analysis
5. Methods of analysis preferred
6. Result destination(s)
7. Electronic data format
8. Invoice destination
9. Sample storage requirements
10. Appropriate warnings if any samples are potentially hazardous
11. Indication of any samples that may cause problems during the preparation or analysis. This includes the presence of normally trace elements at percent levels, visible gold, graphitic shales, etc.

Certain samples may require classification as dangerous goods, for the purpose of transport, processing and storage. Compliance is the client's responsibility, please ensure that the samples have been classified, marked and transported in accordance with the requirements of dangerous goods legislation.

Your co-operation with sample submissions will eliminate unnecessary delays in turnaround.

## Service Fees and Surcharges

Prices in this schedule are effective from 1st March 2023.

All prices in this brochure are calculated on the basis of multiple sample batches rather than individual samples; consequently single sample jobs may incur higher costs depending on analytical requirements. and there is a minimum invoice charge of ₱4752.00.

A waste disposal levy is included in the cost of the analyses that produce lead, alkaline or cyanide based solid or liquid waste that requires specific hazardous waste disposal protocols. Should disposal costs increase prices may be increased accordingly.

A 100% surcharge will be added for any "RUSH" analysis. Please confirm with the laboratory with regards to laboratory workload and results turnaround requirements.

Clients who do not have approved credit lines will be required to pay for the full invoice prior to release of results and maybe asked for a 50% deposit on large sample number submissions prior to work commencing.

Discounts may apply for large batches - please contact Intertek to discuss your needs.

All prices quoted in this schedule are in Philippine Peso, and exclude Philippines Value Added Tax (VAT).

## Quality Assurance

Regular participation in international, national and internal proficiency testing programs and client specific proficiency programs complements ISO/IEC 17025 accreditation ensuring international standards are maintained in the laboratories' procedures, methodology, validation, QA/QC and data handling.

Certified Reference Materials and/or in house controls, blanks and replicates are analysed with each batch of samples. These quality control results are reported along with the sample values in the final report. Selected samples are also re-analysed to confirm anomalous results. Prices include the reporting of all QC data except where more than 10% repeats are considered necessary in cases such as poor reproducibility due to particulate precious metals, in which case additional repeats may be charged for.

Where the concentration of an element exceeds the capacity of the original method selected, re-analysis will be carried out using a more appropriate technique at the client's expense, unless otherwise requested.

## Ethics and Compliance

Intertek is committed to maintaining the total confidence of its customers and shareholders. One of the Group's primary business objectives is to ensure both compliance with local, national and international laws and the accuracy and validity of reports and certificates that it provides to customers.

The foundations of the policy rest with the Group's employees, each of whom must comply with the company's Code of Ethics and Zero Tolerance policies outlining the high standards expected of them in all business dealings.

Our compliance aims:

- To avoid conflicts of interest and to act openly, responsibly and within the confines of the law and internationally accepted guidelines.
- To implement current 'best practice' policies in all control procedures.
- To maintain a culture in which all employees know what is expected of them.
- To monitor adherence to organisational controls and reporting procedures.
- Compliance is a core component of Intertek's business strategy to ensure high standards of professional conduct and ensure ethical behaviour and integrity of services.

# Value Added Services

## Robotics and Automated Minerals Laboratory Systems

Intertek is the largest global commercial operator of automated and robotic mine site laboratories. Intertek automated and robotic sample systems are purpose built, ranging from individual cells to fully integrated systems, providing complete end-to-end sampling to analysis solutions. Using advanced robotic sample handling technology for minerals testing has distinct advantages, including rapid sample throughput, unparalleled consistency, exclusion of human error, a comprehensive audit trail, synchronised process control, reliability and fully programmable comminution parameters. Programmable parameters ensure that ores obtain the requisite treatment consistently. Robotic systems reduce OH&S exposure to employees, eliminating heavy lifting and isolating personnel from hazardous materials, significantly improving safety.

## Minerals Trade Services

Intertek Minerals Trade Services provide independent inspection, sampling, testing and certification services which assist to protect the quantity and quality of mineral commodities to reduce commercial risk in the trading environment. Inspection and testing services are completed to appropriate international standards and procedures.

Non-ferrous commercial exchange assay services are provided by Intertek's industry recognised Laboratory Services International (LSI), based in Rotterdam, Netherlands. LSI is an established umpire laboratory providing analytical services to miners, traders and refiners with a long history of expertise in non-ferrous party and umpire analysis and is an industry leader for accuracy, service quality and independence.

The global Intertek Minerals Inspection Team also performs risk management and inspection services in load and discharge ports alike, offering a full scope of WSMD and party assays, in locations from the Americas, Africa to China and the Far East.

## Mine and Port Site Laboratories

Intertek operates, designs and commissions dedicated mine site laboratories in remote locations to enhance its service to mining operations across multiple mineral commodities. Intertek provides clients with a complete solution for any scale of mine or port site laboratory installation, from concept phase to commissioning and ongoing management and operation.

Intertek's automated and robotic sample systems are purpose built, ranging from individual cells to fully integrated systems providing complete end-to-end sampling to analysis solutions. Intertek Robotic Laboratories (IRL) offers unmatched experience and expertise in the operation of fully automated laboratories in remote locations and is the largest commercial operator of fully automated laboratories globally.

Outsourcing of a mine-site laboratory offers the benefit of Intertek's world-class expertise and services and enables companies to focus resources and capital on their core business.

## Mineralogy

Intertek's leading expertise and state-of-the-art facilities offer a range of mineralogical services. Technical specialists in XRF and XRD support local and global operations, producing quality reliable data with the reassurance of years of experience from onsite XRD specialists and instrumentation.

- Research quality lithogeochemical packages
- Applied bulk mineralogy
- Low cost XRF & spectral scanning
- TerraSpec Near-Infrared Spectroscopy
- FTIR Spectroscopy
- Applied Micro Mineralogy QEMSCAN

## Minerals Environmental Testing Services

Intertek environmental laboratories support the minerals industry with water, soil and air testing to governmental, regulatory and industry standards.

- Water quality
- Sediment and soil analysis
- Acid sulphate soils
- Biological tissue analysis
- Waste analysis and characterisation
- Acid rock drainage prediction test
- Soil nutrient analysis

# Total Sustainability. Assured.

Intertek is uniquely positioned to partner with our clients and meet their needs by delivering a wide variety of sustainability services that help them to manage risk and resilience with increased transparency and confidence, whilst supporting their ability to operate effectively and act responsibly. Intertek's Total Sustainability Assurance is a pioneering initiative that provides an end-to-end independent, systematic sustainability programme from both an operational and corporate perspective.

Intertek's Corporate Sustainability Certification programme, powered by our technical expertise and advanced software platforms, can help your organisation to authentically demonstrate and independently verify its commitment to sustainability across the entire value chain, building stakeholder trust and corporate value. Total Corporate Sustainability Certification is comprised of 10 comprehensive standards, aligned with the UN Sustainable Development Goals, that provide holistic quality, safety and sustainability assurance of operations, services and products, whilst fostering a culture of sustainability through awareness, training and engagement.



## Production Services

Intertek's analytical and scientific services are focused on extending the longevity of plant and equipment and optimising operations.

- Oil Condition Monitoring
- Pipeline inspection and testing
- Refinery Representation and Superintending
- Fuel tank inspection and testing
- Tank/pump inspection and calibration
- Environmental chemistry

## Business Assurance

Management systems auditing helps you find and implement best practices for continual improvement and adds strategic value to your business. Intertek's comprehensive auditing and certification services provide the tools you need to evaluate and continually improve your business processes.

As an accredited third-party registrar, we provide independent verification to ensure that your management system is effective in achieving your business objectives, while also certifying that it meets internationally recognised standards.

## Industry Services

Intertek's Industry Services support the mining, oil and gas, power, construction, engineering, chemical and other heavy industries to manage operational risk and maximise returns. Applying leading inspection, testing, verification and monitoring practices, we assist clients to effectively manage product and process development, regulatory compliance, supply chain integrity and plant and asset maintenance.

- Technical Staffing Services (TSS)
- Technical Inspection Services (TIS)
- Intertek Surveying Services (ISS)
- Non-Destructive Testing (NDT)
- Asset Integrity Management (AIM)

# Conversion Tables

## Useful Chemical Conversion Factors

Element	Factor	Compound	Element	Factor	Compound	Element	Factor	Compound
Al	x 1.889	Al <sub>2</sub> O <sub>3</sub>	Fe	x 1.43	Fe <sub>2</sub> O <sub>3</sub>	Pb	x 1.155	PbS
As	x 1.32	As <sub>2</sub> O <sub>3</sub>	Fe	x 1.574	FeS	Rb	x 1.094	Rb <sub>2</sub> O
B	x 3.22	B <sub>2</sub> O <sub>3</sub>	K	x 1.205	K <sub>2</sub> O	Sb	x 1.197	Sb <sub>2</sub> O <sub>3</sub>
Ba	x 1.699	BaSO <sub>4</sub>	La	x 1.173	La <sub>2</sub> O <sub>3</sub>	Si	x 2.139	SiO <sub>2</sub>
Ba	x 1.117	BaO	Li	x 2.153	Li <sub>2</sub> O	Sn	x 1.27	SnO <sub>2</sub>
Be	x 2.775	BeO	Mg	x 1.658	MgO	Sr	x 1.183	SrO
Ca	x 1.399	CaO	Mg	x 3.648	MgCO <sub>3</sub>	Ta	x 1.221	Ta <sub>2</sub> O <sub>5</sub>
Ca	x 2.497	CaCO <sub>3</sub>	Mn	x 1.291	MnO	Th	x 1.138	ThO <sub>2</sub>
Ce	x 1.171	Ce <sub>2</sub> O <sub>3</sub>	Mn	x 1.582	MnO <sub>2</sub>	Ti	x 1.668	TiO <sub>2</sub>
Co	x 1.271	CoO	Mo	x 1.5	MoO <sub>3</sub>	U	x 1.179	U <sub>3</sub> O <sub>8</sub>
Cr	x 1.462	Cr <sub>2</sub> O <sub>3</sub>	Mo	x 1.668	MoS <sub>2</sub>	V	x 1.785	V <sub>2</sub> O <sub>5</sub>
Cs	x 1.06	Cs <sub>2</sub> O	Na	x 1.348	Na <sub>2</sub> O	W	x 1.261	WO <sub>3</sub>
Cu	x 1.252	CuO	Nb	x 1.432	Nb <sub>2</sub> O <sub>5</sub>	Y	x 1.27	Y <sub>2</sub> O <sub>3</sub>
Cu	x 1.252	Cu <sub>2</sub> S	Ni	x 1.273	NiO	Zn	x 1.245	ZnO
F	x 2.055	CaF <sub>2</sub>	P	x 2.291	P <sub>2</sub> O <sub>5</sub>	Zn	x 1.49	ZnS
Fe	x 1.287	FeO	Pb	x 1.077	PbO	Zr	x 1.351	ZrO <sub>2</sub>

## Common Equivalents

PPM	PPB	%	GRAMS / METRIC TONNE
1	1,000	0.0001	1
10	10,000	0.001	10
100	100,000	0.01	100
1,000	1,000,000	0.1	1,000
10,000	10,000,000	1	10,000

## Drill Core Specifications

DRILL CORE	DIAMETER (MM)	VOLUME PER METER (CM <sup>3</sup> )		
		FULL	HALF	QUARTER
TT	35.0	960	480	240
BQ	36.4	1040	520	260
NQ	47.6	1780	890	445
HQ	63.5	3170	1585	793
BQ3	33.5	880	440	220
NQ3	45.1	1600	800	400
HQ3	61.1	2930	1465	733

Mass (g) = Volume/meter x SG x length (m)

# Recommended Methods of Analysis For Low Grade Geological Materials

-  ICPOES
-  ICPMS
-  Fire Assay (Various Finishes)
-  XRF
-  Other Instrumental (CS Analyser/SIE)

Atomic Number	Element Name	Element Symbol	Atomic Weight	Primary Method	Secondary Method	Other Method
1	Hydrogen	H	1.0079			
3	Lithium	Li	6.941			
4	Beryllium	Be	9.0122			
11	Sodium	Na	22.990			
12	Magnesium	Mg	24.305			
19	Potassium	K	39.098			
20	Calcium	Ca	40.078			
21	Scandium	Sc	44.956			
22	Titanium	Ti	47.867			
23	Vanadium	V	50.942			
24	Chromium	Cr	51.996			
25	Manganese	Mn	54.938			
26	Iron	Fe	55.845			
27	Cobalt	Co	58.933			
28	Nickel	Ni	58.693			
29	Copper	Cu	63.546			
30	Zinc	Zn	65.38			
31	Gallium	Ga	69.723			
32	Germanium	Ge	72.64			
33	Arsenic	As	74.922			
34	Selenium	Se	78.96			
35	Bromine	Br	79.904			
36	Krypton	Kr	83.798			
37	Rubidium	Rb	85.468			
38	Strontium	Sr	87.62			
39	Yttrium	Y	88.906			
40	Zirconium	Zr	91.224			
41	Niobium	Nb	92.906			
42	Molybdenum	Mo	95.96			
43	Technetium	Tc	98			
44	Ruthenium	Ru	101.07			
45	Rhodium	Rh	102.91			
46	Palladium	Pd	106.42			
47	Silver	Ag	107.87			
48	Cadmium	Cd	112.41			
49	Indium	In	114.82			
50	Tin	Sn	118.71			
51	Antimony	Sb	121.76			
52	Tellurium	Te	127.60			
53	Iodine	I	126.90			
54	Xenon	Xe	131.29			
55	Cesium	Cs	132.91			
56	Barium	Ba	137.33			
57	Lanthanum	La	138.91			
58	Cerium	Ce	140.12			
59	Praseodymium	Pr	140.91			
60	Neodymium	Nd	144.24			
61	Promethium	Pm	145			
62	Samarium	Sm	150.36			
63	Europium	Eu	151.96			
64	Gadolinium	Gd	157.25			
65	Terbium	Tb	158.93			
66	Dysprosium	Dy	162.50			
67	Holmium	Ho	164.93			
68	Erbium	Er	167.26			
69	Thulium	Tm	168.93			
70	Ytterbium	Yb	173.05			
71	Lutetium	Lu	174.97			
72	Hafnium	Hf	178.49			
73	Tantalum	Ta	180.95			
74	Tungsten	W	183.84			
75	Rhenium	Re	186.21			
76	Osmium	Os	190.23			
77	Iridium	Ir	192.22			
78	Platinum	Pt	195.08			
79	Gold	Au	196.97			
80	Mercury	Hg	200.59			
81	Thallium	Tl	204.38			
82	Lead	Pb	207.2			
83	Bismuth	Bi	208.98			
84	Polonium	Po	209			
85	Astatine	At	210			
86	Radon	Rn	222			
87	Francium	Fr	223			
88	Radium	Ra	226			
89	Actinium	Ac	227			
90	Thorium	Th	232.04			
91	Protactinium	Pa	231.04			
92	Uranium	U	238.03			
93	Neptunium	Np	237			
94	Plutonium	Pu	244			
95	Americium	Am	243			
96	Curium	Cm	247			
97	Berkelium	Bk	247			
98	Californium	Cf	251			
99	Einsteinium	Es	252			
100	Fermium	Fm	257			
101	Mendelevium	Md	258			
102	Nobelium	No	259			
103	Lawrencium	Lr	262			
104	Rutherfordium	Rf	261			
105	Dubnium	Db	262			
106	Seaborgium	Sg	266			
107	Bohrium	Bh	264			
108	Hassium	Hs	277			
109	Mt	Mt	268			
110	Darmstadtium	Ds	269			
111	Roentgenium	Rg	272			
112	Copernicium	Cn	285			
113	Ununtrium	Uut	284			
114	Ununquadium	Uuq	289			
115	Ununpentium	Uup	288			
116	Ununhexium	Uuh	116			
117	Ununseptium	Uus	117			
118	Ununoctium	Uuo	118			

119	Ununennium	Uue	119			
120	Unbinilium	Uub	120			
121	Untrium	Uut	121			
122	Unquadrium	Uuq	122			
123	Unquadium	Uuq	123			
124	Unpentium	Uup	124			
125	Unsextium	Uus	125			
126	Unseptium	Uus	126			
127	Unoctium	Uuo	127			
128	Unnennium	Uue	128			
129	Unbinilium	Uub	129			
130	Untrium	Uut	130			
131	Unquadrium	Uuq	131			
132	Unquadium	Uuq	132			
133	Unpentium	Uup	133			
134	Unsextium	Uus	134			
135	Unseptium	Uus	135			
136	Unoctium	Uuo	136			
137	Unnennium	Uue	137			
138	Unbinilium	Uub	138			
139	Untrium	Uut	139			
140	Unquadrium	Uuq	140			
141	Unquadium	Uuq	141			
142	Unpentium	Uup	142			
143	Unsextium	Uus	143			
144	Unseptium	Uus	144			
145	Unoctium	Uuo	145			
146	Unnennium	Uue	146			
147	Unbinilium	Uub	147			
148	Untrium	Uut	148			
149	Unquadrium	Uuq	149			
150	Unquadium	Uuq	150			
151	Unpentium	Uup	151			
152	Unsextium	Uus	152			
153	Unseptium	Uus	153			
154	Unoctium	Uuo	154			
155	Unnennium	Uue	155			
156	Unbinilium	Uub	156			
157	Untrium	Uut	157			
158	Unquadrium	Uuq	158			
159	Unquadium	Uuq	159			
160	Unpentium	Uup	160			
161	Unsextium	Uus	161			
162	Unseptium	Uus	162			
163	Unoctium	Uuo	163			
164	Unnennium	Uue	164			
165	Unbinilium	Uub	165			
166	Untrium	Uut	166			
167	Unquadrium	Uuq	167			
168	Unquadium	Uuq	168			
169	Unpentium	Uup	169			
170	Unsextium	Uus	170			
171	Unseptium	Uus	171			
172	Unoctium	Uuo	172			
173	Unnennium	Uue	173			
174	Unbinilium	Uub	174			
175	Untrium	Uut	175			
176	Unquadrium	Uuq	176			
177	Unquadium	Uuq	177			
178	Unpentium	Uup	178			
179	Unsextium	Uus	179			
180	Unseptium	Uus	180			
181	Unoctium	Uuo	181			
182	Unnennium	Uue	182			
183	Unbinilium	Uub	183			
184	Untrium	Uut	184			
185	Unquadrium	Uuq	185			
186	Unquadium	Uuq	186			
187	Unpentium	Uup	187			
188	Unsextium	Uus	188			
189	Unseptium	Uus	189			
190	Unoctium	Uuo	190			
191	Unnennium	Uue	191			
192	Unbinilium	Uub	192			
193	Untrium	Uut	193			
194	Unquadrium	Uuq	194			
195	Unquadium	Uuq	195			
196	Unpentium	Uup	196			
197	Unsextium	Uus	197			
198	Unseptium	Uus	198			
199	Unoctium	Uuo	199			
200	Unnennium	Uue	200			
201	Unbinilium	Uub	201			
202	Untrium	Uut	202			
203	Unquadrium	Uuq	203			
204	Unquadium	Uuq	204			
205	Unpentium	Uup	205			
206	Unsextium	Uus	206			
207	Unseptium	Uus	207			
208	Unoctium	Uuo	208			
209	Unnennium	Uue	209			
210	Unbinilium	Uub	210			
211	Untrium	Uut	211			
212	Unquadrium	Uuq	212			
213	Unquadium	Uuq	213			
214	Unpentium	Uup	214			
215	Unsextium	Uus	215			
216	Unseptium	Uus	216			
217	Unoctium	Uuo	217			
218	Unnennium	Uue	218			
219	Unbinilium	Uub	219			
220	Untrium	Uut	220			
221	Unquadrium	Uuq	221			
222	Unquadium	Uuq	222			
223	Unpentium	Uup	223			
224	Unsextium	Uus	224			
225	Unseptium	Uus	225			
226	Unoctium	Uuo	226			
227	Unnennium	Uue	227			
228	Unbinilium	Uub	228			
229	Untrium	Uut	229			
230	Unquadrium	Uuq	230			
231	Unquadium	Uuq	231			
232	Unpentium	Uup	232			
233	Unsextium	Uus	233			
234	Unseptium	Uus	234			
235	Unoctium	Uuo	235			
236	Unnennium	Uue	236			
237	Unbinilium	Uub	237			
238	Untrium	Uut	238			
239	Unquadrium	Uuq	239			
240	Unquadium	Uuq	240			
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242	Unsextium	Uus	242			
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245	Unnennium	Uue	245			
246	Unbinilium	Uub	246			
247	Untrium	Uut	247			
248	Unquadrium	Uuq	248			
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251	Unsextium	Uus	251			
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253	Unoctium	Uuo	253			
254	Unnennium	Uue	254			
255	Unbinilium	Uub	255			
256	Untrium	Uut	256			
257	Unquadrium	Uuq	257			
258	Unquadium	Uuq	258			
259	Unpentium	Uup	259			
260	Unsextium	Uus	260			
261	Unseptium	Uus				

# Intertek Minerals Services Terms and Conditions (2023)

- 1.0 1.0 Unless otherwise specifically agreed in writing Intertek Minerals (hereinafter called "the Company") undertakes services in accordance with these general conditions (hereinafter called "General Conditions") and accordingly all offers or tenders of service are made subject to these General Conditions. All resulting contracts, agreements or other arrangements will in all respects be governed by these General Conditions, except only to the extent that the law of the place where such arrangements or contracts are made or carried out shall preclude any of the General Conditions and in such case such local law shall prevail wherever, but only to the extent that, it is at variance with these General Conditions.
- 1.1 For the purposes of these conditions the term "Intertek Minerals" comprises all of the Intertek subsidiaries carrying out Minerals testing and inspection activities including but not limited to Intertek, Intertek Minerals, Intertek Genalysis, Intertek Testing Services (Australia) Pty Ltd, Intertek Robotic Laboratories Pty Ltd, (IRL), PT Intertek Utama Services (IUS), ITS (PNG) Ltd, Genalysis Laboratory Services Pty Ltd, Intertek Genalysis South Africa Pty Ltd, Intertek NTEL, Intertek Minerals Limited, Intertek Testing Services Philippines Inc, Intertek Genalysis Namibia (Pty) Ltd, Intertek International Tanzania Ltd, ITS West Africa, Intertek Commodities Botswana, Intertek Genalysis (Zambia) Ltd, Intertek Genalysis SI Ltd, Intertek LSI, Laboratory Services International Rotterdam B.V.
- 2.0 The Company is an enterprise engaged in the trade of inspection and testing. As such, it:
- 2.1 carries out such standard services as are referred to in General Condition 6;
- 2.2 renders advisory and special services as may be agreed by the Company and as referred to in General Condition 7; and
- 2.3 issues reports and/or certificates as referred to in General Condition 8.
- 3.0 The Company acts for the persons or bodies from whom the instructions to act have originated (hereinafter called "the Principal"). No other party is entitled to give instructions, particularly on the scope of inspection or delivery of report or certificate, unless so authorized by the Principal and agreed by the Company. The Company will however be deemed irrevocably authorized to deliver at its discretion the report or the certificate to a third party if following instructions by the Principal a promise in this sense had been given to this third party or such a promise implicit follows from circumstances, trade custom, usage or practice.
- 4.0 The Company will provide services in accordance with:
- 4.1 the Principal's specific instructions as confirmed by the Company;
- 4.2 the terms of the Company's Standard Order Form, Sample Submission Form and/or Standard Specification Sheet if used;
- 4.3 any relevant trade custom, usage or practice; and
- 4.4 such methods as the Company shall consider appropriate on technical, operational and/or financial grounds.
- 5.0 5.1 All enquiries and orders for the supply of services must be accompanied by sufficient information specifications and instructions to enable the Company to evaluate and/or perform the services required.
- 5.2 Documents reflecting engagements contracted between the Principal and third parties, or third parties' documents, such as copies of contracts of sale, letters of credit, bills of lading, etc., are (if received by the Company) considered to be for information only, without extending or restricting the mission or obligations accepted by the Company.
- 6.0 The Company's standard services may include all or any of the following:
- 6.1 quantitative and/or qualitative inspection;
- 6.2 inspection of goods, plant, equipment, packing, tanks, containers and means of transport;
- 6.3 inspection of loading or discharging;
- 6.4 sampling;
- 6.5 laboratory analysis or other testing; and
- 6.6 surveys and audits.
- 7.0 Special services where the same exceed the scope of standard services as referred to in General Condition 6 will only be undertaken by the Company by particular arrangement. Such special services are illustratively not exhaustively:
- 7.1 qualitative and/or quantitative guarantees;
- 7.2 supply of technicians and other personnel;
- 7.3 pre-shipment inspection under government mandated import or customs schemes; and
- 7.4 advisory services.
- 8.0 8.1 Subject to the Principal's instructions as accepted by the Company, the Company will issue reports and certificates of inspection which reflect statements of opinion made with due care within the limitation of instructions received but the Company is under no obligation to refer to or report upon any facts or circumstances which are outside the specific instructions received.
- 8.2 Reports or certificates issued following testing or analysis of samples contain the Company's specific opinion on those samples as received only but do not express any opinion upon the bulk from which the samples were drawn. If an opinion on the bulk is requested special arrangements must be made in advance with the Company for the inspection and sampling of the bulk.
- 8.3 Upon payment of the total sum due to the Company by the Principal, the Principal shall have a perpetual, irrevocable, fully paid up and royalty free licence to use the final report or certificate. The Company shall own all analysis, data and intellectual property generated pursuant to the creation of the report or certificate.
- 9.0 The Principal will:
- 9.1 ensure that instructions to the Company and sufficient information are given in due time to enable the required services to be performed effectively;
- 9.2 procure all necessary access for the Company's representatives to enable the required services to be performed effectively;
- 9.3 supply, if required, any special equipment and personnel necessary for the performance of the required services;
- 9.4 ensure that all necessary measures are taken for safety and security of working conditions, sites and installations during the performance of services and will not rely, in this respect, on the Company's advice whether requested or not;
- 9.5 take all necessary steps to eliminate or remedy any obstruction to or interruptions in the performance of the required services;
- 9.6 inform the Company in advance of any known hazards or dangers, actual or potential, associated with any order or samples or testing including, for example, presence or risk of radiation, toxic or noxious or explosive elements or materials, environmental pollution or poisons; and
- 9.7 fully exercise all its rights and discharge all its liabilities under any related contract whether or not a report or certificate has been issued by the Company failing which the Company shall be under no obligation to the Principal.

- 10.0 The Company shall be entitled at its discretion to delegate the performance of the whole or any part of the services contracted for with the Principal to any agent or subcontractor. Where deemed appropriate by the company, prior consent will be sought from the Principal.
- 11.0 If the requirements of the Principal necessitate the analysis of samples by the Principal's or by any third party's laboratory the Company will pass on the result of the analysis but without responsibility for its accuracy. Likewise where the Company is only able to witness an analysis by the Principal's or by any third party's laboratory the Company will provide confirmation that the correct sample has been analysed but will not otherwise be responsible for the accuracy of any analysis or results.
- 12.0 12.1 The Company undertakes to exercise due care and skill in the performance of its services and accepts responsibility only where such skill and care is not exercised.
- 12.2 All samples submitted to the Company remain the property of the Principal. The Company shall not be liable for any claim whatsoever relating to deterioration, contamination, damage or loss of samples. The Principal indemnifies the Company against any claims or legal action resulting from damage, deterioration or loss of samples.
- 12.3 The liability of the Company in respect of any claims for loss, damage or expense of whatsoever nature and howsoever arising in respect of any breach of contract and/or any failure to exercise due skill and care by the Company shall in no circumstances exceed a total aggregate sum equal to Fifteen (15) times the amount of the fee or commission paid or payable in respect of the specific service or test required under the particular contract with the Company which gives rise to such claims, or US\$15,000, whichever is least, provided however that the Company shall have no liability in respect of any claims for indirect or consequential loss including loss of profit and/or loss of future business and/or loss of production and/or cancellation of contracts entered into by the Principal. Where the fee or commission payable relates to a number of services and a claim arises in respect of one of those services the fee or commission may be apportioned for the purposes of this paragraph by reference to the estimated time involved in the performance of each service or the value of the individual services.
- 12.4 The limit of liability of the Company under the terms of Condition 12.2 may be increased upon request received by the Company in advance of the performance of the service to such figure as agreed in writing.
- 13.0 The Principal shall guarantee, hold harmless and indemnify the Company and its officers, employees, agents or subcontractors against all claims made by any third party for loss, damage or expense of whatsoever nature and howsoever arising relating to the performance, purported performance or non-performance of any services to the extent that the aggregate of any such claims relating to any one service exceed the limit mentioned in Condition 12.
- 14.0 Every officer, employee, agent or subcontractor of the Company shall have the benefit of the limitation of compensation and the indemnity contained in these General Conditions and so far as relates to such limitations any contract entered into by the Company is entered into not only on its own behalf but also as agent and trustee for every such person as aforesaid.
- 15.0 In the event that any unforeseen problems or expenditure arise in the course of carrying out any of the contracted services the Company shall be entitled to make reasonable additional charges to cover additional time and cost necessarily incurred to complete the service.
- 16.0 16.1 The Principal will punctually pay not later than Thirty (30) days after the relevant invoice date or upon receipt of invoice where credit is not extended or a credit limit is exceeded or within such other period as may have been agreed in writing by the Company all proper charges rendered by the Company failing which interest will become due at the rate of Eighteen per cent (18%) per annum or one and a half percent (1.5%) per month from the date of invoice until payment.
- 16.2 The Principal shall not be entitled to retain or defer payment of any sums due to the Company on account of any dispute, cross claim or set off which it may allege against the Company.
- 16.3 In the event of any suspension of payment arrangement with creditors, bankruptcy, insolvency, receivership or cessation of business by the Principal, or failure by the Principal to meet payment obligations in this clause 16 the Company shall be entitled to suspend all further performance of its services forthwith and without liability.
- 17.0 In the event of the Company being prevented by reason of any cause whatsoever outside the Company's control from performing or completing any service for which an order has been given or an agreement made, the Principal will pay to the Company:
- 17.1 the amount of all abortive expenditure actually made or incurred; and
- 17.2 a proportion of the agreed fee or commission equal to the proportion (if any) of the service actually carried out and the Company shall be relieved of all responsibility whatsoever for the partial or total non-performance of the required service.
- 18.0 The Company shall be discharged from all liability to the Principal for all claims for loss, damage or expense unless suit is brought within twelve (12) months after the date of the performance by the Company of the service which gives rise to the claim or in the event of any alleged non-performance within three (3) months of the date when such service should have been completed.
- 19.0 The Company is neither an insurer nor a guarantor and disclaims all liability in such capacity. Principals seeking a guarantee against loss or damage should obtain appropriate insurance.
- 20.0 No alteration, amendment or waiver of any of these General Conditions shall have any effect unless made in writing and signed by an officer of the Company
- 21.0 Upon completion of testing the Company shall provide a report to the Principal on the results of the testing. Where requested by the Principal provisional results may be provided however the Principal agrees that those results shall be subject to confirmation in a final report.
- 22.0 The Company agrees to take reasonable measures to ensure that the results of Inspection or Testing on behalf of the Principal and any other information provided to the Company are kept confidential provided that this provision will not apply where the results or other information are in the public domain.
- 23.0 The Company shall have no responsibility for any action or inaction of any carrier, shipping or delivering any sample to or from the Company premises.
- 24.0 Samples shall be stored free of charge for a period of sixty (60) days after provision of the invoice. Upon expiration of the free storage period, unless otherwise directed by the Principal storage fees and/or disposal charges shall apply.
- 25.0 All data will be retained for a seven (7) year period; fees may apply for retrieval of data if longer than three (3) months after the final report date.



# Global Locations

## Asia Pacific

### Australia

#### Intertek Genalysis

Perth Minerals Head Office and Laboratory  
544 Bickley Road, Maddington, Western Australia 6109  
Tel: +61 8 9263 0100 | Email: min.aus.per@intertek.com  
Sample Deliveries: 311 Kenwick Road, Maddington,  
Western Australia 6109

#### Intertek Robotic Laboratories

Tel: +61 8 9251 8100 | Email: min.aus.irl@intertek.com

#### Kalgoorlie Sample Preparation Facility

12 Keogh Way, Kalgoorlie, Western Australia 6430  
Tel: +61 8 9021 6057 | Email: min.aus.kal@intertek.com

#### Port Hedland Inspection and Sample Preparation

116 Pinnacles Street Wedgefield, Western Australia 6721  
Tel: +61 8 9172 4288 | Email: hedland@intertek.com

#### Adelaide Laboratory

11 Senna Road, Wingfield, South Australia 5013  
Tel: +61 8 8162 9714 | Email: min.aus.adl@intertek.com

#### Townsville Laboratory

9-23 Kelli Street, Bohle, Queensland 4818  
Tel: +61 7 4774 3655 | Email: min.aus.tsv@intertek.com

#### Darwin Laboratory (NTEL)

55 Export Drive, East Arm, Northern Territory 0822  
Tel: +61 8 8947 0510 | Email: ntel@intertek.com

#### Alice Springs Sample Preparation Facility

41 Ghan Rd, Alice Springs, Northern Territory, 0870  
Tel: +61 8 8952 3938 | Email: min.aus.asp@intertek.com

### China

#### Shanghai Head Office & Coal Laboratory

Tel: +86 21 6127 6288 | Email: adam.huang@intertek.com

#### Tianjin Mineral and Coal Laboratory

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#### Rizhao Office and Inspection

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### Indonesia

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#### Jakarta Environmental Laboratory

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#### Samarinda East Kalimantan Coal Laboratory

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#### Padang (West Sumatra) Sample Preparation Facility

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#### Manado (North Sulawesi) Sample Preparation Facility

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#### Kendari (SE Sulawesi) Inspection and Sample Preparation Facility

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### Papua New Guinea

#### LAE Laboratory

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### Philippines

#### Manila Minerals Head Office and Laboratory

Tel: +63 2 8423464 | Email: min.apac.phl.lab@intertek.com

#### Surigao Sample Preparation Facility

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### South Korea

#### Seoul Inspection and Head Office

Tel: +82 2 860 0271 | Email: raymond.sohn@intertek.com

### Thailand

#### Bangkok Head Office

Tel: +66 (2) 279 5040 | Email: wilai.suphasin@intertek.com

## North and South America

### Brazil

#### Nova Lima Minerals Office

Tel: +55 31 3581-8854 | Email: fernanda.moreiran@intertek.com

### Canada

#### Vancouver Coal Laboratory

Tel: +1 604 454 9011 | Email: vancouver.ops@intertek.com

#### Prince Rupert Coal Laboratory

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#### Thunder Bay Coal Inspection and Sample Preparation

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#### Montreal Coal Inspection and Sample Preparation

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### USA

#### Chicago Coal Laboratory

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#### New Orleans NOLA Coal Sample Preparation Facility

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#### Shenango Pittsburgh Coal Laboratory

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#### St Louis Coal Sample Preparation Facility

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## Europe, the Middle East and Africa

### Eritrea

#### Adi Guadad, Eritrea Sample Preparation Facility

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### Ghana

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### Netherlands

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### South Africa

#### Johannesburg Laboratory

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### Zambia

#### Chingola Sample Preparation Facility

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Inspection Services are available at all major ports & distribution centres. website on up to date information on locations, services and fact sheets [www.intertek.com/minerals/](http://www.intertek.com/minerals/)



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