

# Schedule of Services & Charges 2025

Minerals Services  
Papua New Guinea



# 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.  
46,000 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 Storage

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

Description	Code	Price
Storage of bulk, pulp or residue samples	ST111	PGK1.60/sample/month
Bulk disposal of samples	ST211	At cost
Expenses related to return	ST311	At cost
Retrieval of selected pulps per sample	ST401	PGK36.20/initial charge
Retrieval of selected pulps per sample	ST402	PGK173.40/additional charge per hour
Retrieval of selected pulps per sample	ST403	PGK54.50/initial charge
Retrieval of selected pulps per sample	ST404	PGK173.40/additional charge per hour
Supply of pallets	ST405	PGK108.50
Collection of samples from NAZDAB	ST406	PGK577.90
Collection of samples from Lae Port	ST407	PGK329.50

## Sample Preparation Packages

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

### Soils, Stream Sediments, Pan Concentrates

Description	Code	Price
Sort, dry (105°C), pulverise all (95% < 75µm) up to 2.0kg	PF01	PGK16.70

### Preparation Package

Description	Code	Price
Sort, dry (105°C), crush (95% < 3mm), pulverise 1.5 kg (95% < 75µm) up to 2.0kg	PT01	PGK26.60
Sort, dry (105°C) crush (95% < 3mm), RSD, pulverise 1.5kg (95% < 75µm) up to 2.0kg	PB04	PGK29.90
Additional weight	PB04	PGK7.80
Sort, dry (105°C), Crush (95% < 3mm), RSD, pulverise (95% < 106µm) up to 3.0kg	PB05	PGK29.90
Additional weight	PB05	PGK7.80/kg

### Miscellaneous Procedures

Description	Code	Price
Environmental waste disposal levy - fire assay	WL-FA	PGK2.20
Reporting weights of samples , wet or dry		PGK2.30
Compositing/Homogenising < 2kg	CM201	PGK7.30
Compositing/Homogenising additional weight	CM202	PGK2.30/kg

### Photon Procedures

Description	Code	Price
Photon jar	PH_JAR	PGK3.20
Additional split from original sample	PA_SPT	PGK4.80
Additional re-split of sample	PA_RSPT	PGK8.20

### Portable XRF Scan

Portable XRF technology provides rapid, reliable semi-quantitative scan data on a prepared pulp sample while quantitative analytical suites are conducted. Analysing correctly-prepared pulps in a controlled laboratory environment minimises process variability in contrast with in-field analysis of un-prepared materials using battery operated units. A total of 37 elements are reported using a Geo-exploration mode i.e. calibrated for low level silicate matrix samples. Other custom instrument calibrations can be made available on request. Sample preparation charges are in addition to the XRF scan.

Description	Code	Price
Ag, Al, As, Ba, Bi, Ca, Cd, Ce, Co, Cr, Cu, Fe, Hg, K, La, Mg, Mn, Mo, Nb, Ni, P, Pb, Rb, S, Sb, Se, Si, Sn, Sr, Th, Ti, U, V, W, Y, Zn, Zr.	pXscanE	PGK20.80

Portable XRF data are subject to limitations, for stand-alone portable XRF scan analysis we recommend all significant or anomalous data be checked by conventional methods.

### Freight

Freight expenses incurred will be passed on at cost. For further information please contact the laboratory.

# 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	25g fire assay / AAS	0.01ppm	FA25/AA	PGK46.30
Au	50g fire assay / AAS	0.005ppm	FA50/AA	PGK50.20
Au	25g fire assay / ICP-OES	1ppb	FA25/OE02	PGK51.20
	50g fire assay / ICP-OES		FA50/OE02	PGK52.40

Concentrates, metallurgical and high grade samples

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	1kg Screen fire assay 150µm / AAS	0.01ppm	SF150/AA	PGK218.80
	1kg Screen fire assay 100µm / AAS		SF100/AA	PGK320.70
	1kg Screen fire assay 75µm / AAS		SF75/AA	PGK252.80
	Additional oversize firing			PGK40.80

## Cyanide Leaches

Cyanide extractable gold analysis is used in a range of applications from identification of low level anomalies by BLEG in grassroots exploration to accelerated leaches mimicking metallurgical recovery processes.

### Accelerated Cyanide Leach LeachWELL™

High grade cyanide leaches utilise the LeachWELL™ accelerant to determine the cyanide extractable gold and provide an indication of potential recoveries in metallurgical processes and circuits. Recovery and analysis of the residues provide the option of reporting total gold values and thus determining the refractory gold fraction.

Element	Description	Detection Limit	Code	Price
Au	200g leach / AAS	0.01ppm	LW200/SAA	POA
	400g leach / AAS		LW400/SAA	POA
	1000g leach / AAS		LW1000/SAA	POA
Ag	As an additional element	1ppm	/MS	POA

Tail recovery, entire tail is washed, re-homogenised and analysed by fire assay for Au:

Element	Description	Detection Limit	Code	Price
Au	200g wash / grind / fire assay / AAS	0.01ppm	TR200/AA	POA
	400g wash / grind / fire assay / AAS		TR400/AA	POA
	1000g wash / grind / fire assay / AAS		TR1000/AA	POA

## PhotonAssay Analysis

Chryso™ PhotonAssay is a high-energy X-ray source that is used to irradiate large mineral samples, typically about 0.5 kg. The X-rays induce short-lived changes in the structure of any gold nuclei present. As the excited gold nuclei return to their ground state, they emit a characteristic gamma-ray signature, the intensity of which is directly proportional to the concentration of gold.

The penetrating nature of Chryso™ PhotonAssay provides much higher energy than those used in conventional X-ray fluorescence (XRF), which provides a true bulk analysis of the entire sample. Samples are presented into a fully automatic process where samples are irradiated, measured, data collection and reporting.

Element	Description	Detection Limit	Code	Price
Au	Standard gold analysis 2 cycle	0.03ppm - 350ppm	PAAU02	PGK48.5

The nominal 2 sigma Lower Detection Limit (LDL) for Au is 0.02-0.03 ppm, for samples with low concentrations of interfering elements, namely a combined U and Th concentration of less than 15 ppm and Ba concentration of less than 3,000 ppm. Elevated U, Th, Ba levels will increase detection limit and decrease precision.

# 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 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.

The 1g options are primarily intended as a multi-element scanning tool. The precious metal results may be indicative only and should be interpreted with caution owing to the deportment of these elements in geological many sample types. Larger sample masses (e.g. 10g or 25g) can offer a more reliable precious metal analysis. Individual elements are available on request.

#### Aqua Regia 32 Element Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	0.5 - 250	Cu	1 - 2%	S	50 - 5%
Al	20 - 10%	Fe	0.01% - 50%	Sb	2 - 5000
As	5 - 5000	K	20 - 5%	Sc	1 - 2500
B	10 - 1%	La	20 - 2500	Sr	1 - 5000
Ba	2 - 2000	Mg	0.01% - 20%	Te	2 - 1000
Bi	2 - 5000	Mn	1 - 2%	Ti	5 - 1%
Ca	0.01% - 40%	Mo	1 - 5000	Tl	5 - 1000
Cd	0.5 - 1000	Na	0.01% - 5%	V	2 - 5000
Ce	20 - 5000	Ni	1 - 2%	W	2 - 1000
Co	1 - 1%	P	20 - 2%	Zn	1 - 2%
Cr	2 - 1%	Pb	1 - 5000		
Aqua regia digestion 1g			AR1/OE32	PGK75.20	

Additional elements and larger packages available on request

#### Aqua Regia 52 Element Package

Element	Range ppm	Element	Range ppm	Element	Range ppm
Au	1ppb - 2	Hg	0.1 - 100	Sb	0.02 - 5000
Ag	0.05 - 250	In	0.01 - 1000	Sc	0.1 - 2500
Al	20 - 10%	K	20 - 5%	Se	1 - 5000
As	1 - 5000	La	0.005 - 2500	Sn	0.05 - 1000
B	10 - 1%	Li	0.1 - 2500	Sr	0.02 - 5000
Ba	1 - 2000	Mg	0.01% - 20%	Ta	0.01 - 1000
Be	0.05 - 1000	Mn	1 - 2%	Te	0.1 - 1000
Bi	0.01 - 5000	Mo	0.1 - 5000	Th	0.01 - 2500
Ca	0.01% - 40%	Na	0.01% - 5%	Ti	5 - 1%
Cd	0.01 - 1000	Nb	0.02 - 1000	Tl	0.01 - 1000
Ce	0.005 - 5000	Ni	0.5 - 2%	U	0.01 - 5000
Co	0.1 - 1%	P	20 - 2%	V	2 - 5000
Cr	1 - 2%	Pb	0.5 - 5000	W	0.05 - 1000
Cs	0.01 - 1000	Pd	10ppb - 500ppb	Y	0.02 - 2000
Cu	0.5 - 2%	Pt	5ppb - 500ppb	Zn	1 - 2%
Fe	0.01% - 50%	Rb	0.02 - 1000	Zr	0.1 - 1000
Ga	0.05 - 500	Re	0.001 - 500		
Hf	0.01 - 1000	S	50 - 5%		
Aqua regia digestion 1g			AR1/OM52	PGK122.80	

Instrument finish may vary between locations.

Au 0.01ppm, 0.1ppb options available on request

### Rare Earth Elements (REE) 12 Element Add On

Additional rare earth elements are available as a supplementary package to the AR1, AR10 and AR25 digestion packages.

Element	Range ppm	Element	Range ppm	Element	Range ppm
Pr	0.005 - 2500	Gd	0.005 - 1000	Er	0.005 - 1000
Nd	0.005 - 2500	Tb	0.005 - 1000	Tm	0.005 - 1000
Sm	0.005 - 2500	Dy	0.005 - 1000	Yb	0.005 - 1000
Eu	0.005 - 1000	Ho	0.005 - 1000	Lu	0.005 - 1000
REE add on			*/MS52R or *OM52R		PGK31.90

Detection limits may vary between locations.

### 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.

Description	Code	Price
Aqua regia digestion 1g / ICP first element	AR1/OM	PGK34.00
Aqua regia digestion 1g / secondary instrument first element		PGK25.60
/ per additional element		PGK2.80

## 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 33 Element Package

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	20 - 5000	Sc	1 - 5000
Ba	2 - 5000	Li	1 - 5000	Sn	5 - 2000
Bi	5 - 1%	Mg	20 - 40%	Sr	1 - 1%
Ca	50 - 40%	Mn	1 - 5%	Te	5 - 2000
Cd	0.5 - 2000	Mo	2 - 1%	Ti	5 - 2%
Ce	20 - 1%	Na	20 - 10%	Tl	10 - 2000
Co	1 - 2%	Ni	1 - 2%	V	1 - 2%
Cr	5 - 2%	P	50 - 5%	W	5 - 2000
Cu	1 - 2%	Pb	5 - 1%	Zn	1 - 2%
4A/OE33				PGK78.60	

### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

### Four Acid 48 Element 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%	In	0.01 - 2000	Sc	0.1 - 5000
As	0.5 - 1%	K	20 - 10%	Se	0.5 - 1%
Ba	0.1 - 5000	La	0.01 - 5000	Sn	0.1 - 2000
Be	0.05 - 2000	Li	0.1 - 5000	Sr	0.05 - 1%
Bi	0.01 - 1%	Mg	20 - 40%	Ta	0.01 - 2000
Ca	50 - 40%	Mn	1 - 5%	Te	0.2 - 2000
Cd	0.02 - 2000	Mo	0.1 - 1%	Th	0.01 - 5000
Ce	0.01 - 1%	Na	20 - 10%	Ti	5 - 2%
Co	0.1 - 2%	Nb	0.05 - 2000	Tl	0.02 - 2000
Cr	1 - 2%	Ni	0.5 - 2%	U	0.01 - 1%
Cs	0.05 - 2000	P	50 - 5%	V	1 - 2%
Cu	0.5 - 2%	Pb	0.5 - 1%	W	0.1 - 2000
Fe	100 - 50%	Rb	0.05 - 2000	Y	0.05 - 2000
Ga	0.05 - 2000	Re	0.002 - 2000	Zn	1 - 2%
Ge	0.1 - 2000	S	500 - 10% (50 - 10%*)	Zr	0.1 - 2000

Low level S 50ppm option\* 4A/MS48 PGK128.50  
4A/OM48 PGK142.80

### Rare Earth 12 Elements Add On

Rare earth elements are available as a supplementary package.

Element	Range ppm	Element	Range ppm	Element	Range ppm
Pr	0.01 - 5000	Gd	0.01 - 2000	Er	0.01 - 2000
Nd	0.01 - 5000	Tb	0.01 - 2000	Tm	0.01 - 2000
Sm	0.01 - 5000	Dy	0.01 - 2000	Yb	0.01 - 2000
Eu	0.01 - 2000	Ho	0.01 - 2000	Lu	0.01 - 2000

4A/MS48R or 4A/OM48R PGK33.30

### Four Acid Digest 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.

Description	Code	Price
4 acid digestion	4A/OM	/ ICP first element PGK55.40
		/ secondary instrument first element PGK26.80
		/ per additional element PGK2.90

### Legend

Complete recovery for most samples	Near complete recovery for most samples	Not complete recovery
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# Battery & Energy Metals

With the push towards a net zero future, the production of renewable energy sources is becoming increasingly more important. Technologies such as wind power, solar power, and batteries need a wide range of minerals to produce. Often these minerals have unique properties that cause difficulties when quantifying compositions using traditional methodology. This section is designed for you to pick the most suitable package when you need to analyse your battery and energy minerals. Included in this section are packages for both exploration and ore grade lithium, full quantification and ion exchangeable rare earths, uranium analysis, and graphites.



# Lithium

Lithium is a commodity of interest in the renewable energy sector being a major component in batteries. Two packages are available for the quantification of lithium; an exploration package using a multi-acid digest to achieve the necessary low detection limits, and an ore grade package using a peroxide fusion to ensure that accuracy and precision is achieved at higher concentrations.

## 48 Element Lithium Exploration Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Li	0.1 - 1%	MS	Ge	0.1 - 2000	MS	Sb	0.05 - 1%	MS
Ag	0.05 - 500	MS	Hf	0.05 - 2000	MS	Sc	0.1 - 5000	MS
Al	50 - 15%	MS	In	0.01 - 2000	MS	Se	0.5 - 1%	MS
As	0.5 - 1%	MS	K	20 - 10%	MS	Sn	0.1 - 2000	MS
Ba	0.1 - 5000	MS	La	0.01 - 5000	MS	Sr	0.05 - 1%	MS
Be	0.05 - 2000	MS	Mg	20 - 40%	MS	Ta	0.01 - 2000	MS
Bi	0.01 - 1%	MS	Mn	1 - 5%	MS	Te	0.2 - 2000	MS
Ca	50 - 40%	MS	Mo	0.1 - 1%	MS	Th	0.01 - 5000	MS
Cd	0.02 - 2000	MS	Na	20 - 10%	MS	Ti	5 - 2%	MS
Ce	0.01 - 1%	MS	Nb	0.05 - 2000	MS	Tl	0.02 - 2000	MS
Co	0.1 - 2%	MS	Ni	0.5 - 2%	MS	U	0.01 - 1%	MS
Cr	1 - 2%	MS	P	50 - 5%	MS	V	1 - 2%	MS
Cs	0.05 - 2000	MS	Pb	0.5 - 1%	MS	W	0.1 - 2000	MS
Cu	0.5 - 2%	MS	Rb	0.05 - 2000	MS	Y	0.05 - 2000	MS
Fe	100 - 50%	MS	Re	0.002 - 2000	MS	Zn	1 - 2%	MS
Ga	0.05 - 2000	MS	S	500 - 10%	MS	Zr	0.1 - 2000	MS
Lithium 4 acid digestion			/MS			4A-Li/MS48		PGK120.90

## Nickel Crucible Lithium Ore Grade Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Li	5 - 20%	OES	Fe	100 - 75%	OES	S	500 - 60%	OES
Al	100 - 50%	OES	K	500 - 20%	OES	Sn	2 - 50%	MS
B	50 - 10%	OES	Mg	100 - 60%	OES	Sr	20 - 20%	MS
Ba	1 - 2%	MS	Mn	0.2% - 75%	OES	Ta	0.1 - 50%	MS
Be	1 - 2%	MS	Nb	10 - 30%	MS	W	1 - 50%	MS
Ca	0.1% - 70%	OES	P	100 - 50%	OES			
Cs	0.1 - 1%	MS	Rb	0.5 - 5%	MS			
Sodium peroxide fusion Ni crucible			/MS, OES			FP6-Li/OM19		PGK124.00

## Zirconium Crucible Fusion OES Individual Element

Element	Description	Range PPM	Code	Price
Li	Sodium peroxide fusion Zr Crucible	1 - 20%	FP1-Li/OE	PGK70.50

## Brine Analysis

Description	Code	Price
As, B, Ba, Ca, Co, Cr, Cs, Fe, K, Li, Na, Ni, Mg, Mn, P, Pb, Rb, S, Sc, Se, Sr, Ti, V, Zn	BR-Li01	PGK101.00

Detection limits will be dependent on salinity levels. Upper limits may apply for some elements.

Description	Range	Code	Price
Chloride by Colorimetry	5 mg/l	COL01	PGK60.60

## Brine PH, EC, TDS, SO4, Total Alkalinity Package

Description	Code	Price
pH, EC, TDS, Sulphate (calculated from S), HCO <sub>3</sub> , OH, CO <sub>3</sub> by titration	BR-Li02	PGK201.80

## Rare Earth Elements

Rare earth elements will play a significant role in the push towards net zero. The rare earth packages provided cover the 15 rare earth elements from Yttrium to Lutetium. The name rare earth is deceiving as they are relatively abundant in the earth's crust, however, they are generally dispersed and do not exist as concentrated ores, therefore correct analysis for your samples is imperative. Two fusion packages are offered for rare earth elemental analysis; a peroxide fusion and a borate fusion. These samples can be analysed via ICP-MS-QQQ for an interference free analysis of rare earths to achieve the low detection limits required for exploration samples. An XRF package is offered for precise quantification of the high concentration samples.

### Ree Mineralisation NA Peroxide Fusion MS Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
La	0.2 - 20%	MS	Ho	0.1 - 2%	MS	Ta	0.1 - 50%	MS
Ce	0.5 - 30%	MS	Er	0.1 - 5%	MS	Hf	0.1 - 5%	MS
Pr	0.1 - 10%	MS	Tm	0.1 - 1%	MS	Zr	5 - 50%	MS
Nd	0.1 - 20%	MS	Yb	0.1 - 5%	MS	Sn	2 - 50%	MS
Sm	0.1 - 10%	MS	Lu	0.1 - 1%	MS	W	1 - 50%	MS
Eu	0.1 - 5%	MS	Y	0.5 - 50%	MS	Li	1 - 20%	MS
Gd	0.1 - 5%	MS	Th	0.1 - 2%	MS	Be	1 - 2%	MS
Tb	0.1 - 2%	MS	U	0.1 - 60%	MS	Ga	1 - 5%	MS
Dy	0.1 - 5%	MS	Nb	10 - 30%	MS			
Sodium peroxide fusion Ni crucible			/MS			FP6/MS33		PGK131.90

### Ree Mineralisation LI Borate Fusion MS Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
La	0.2 - 20%	MS	Ho	0.1 - 2%	MS	Nb	0.1 - 5%	MS
Ce	0.5 - 30%	MS	Er	0.1 - 5%	MS	Ta	0.1 - 5%	MS
Pr	0.1 - 10%	MS	Tm	0.1 - 1%	MS	Hf	0.1 - 5%	MS
Nd	0.1 - 20%	MS	Yb	0.1 - 5%	MS	Zr	1 - 50%	MS
Sm	0.1 - 10%	MS	Lu	0.1 - 1%	MS	Sn	1 - 5%	MS
Eu	0.1 - 5%	MS	Y	0.5 - 50%	MS	W	1 - 5%	MS
Gd	0.1 - 5%	MS	Th	0.1 - 2%	MS	Ga	0.5 - 5%	MS
Tb	0.1 - 2%	MS	Be	0.5 - 2%	MS			
Dy	0.1 - 5%	MS	U	0.1 - 20%	MS			
Li borate fusion			/MS			FB6/MS34		PGK128.90

### REE XRF Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
La <sub>2</sub> O <sub>3</sub>	0.01 - 15	XRF	U <sub>3</sub> O <sub>8</sub>	0.01 - 3	XRF	Na <sub>2</sub> O	0.01 - 100	XRF
CeO <sub>2</sub>	0.01 - 30	XRF	ThO <sub>2</sub>	0.01 - 3	XRF	P <sub>2</sub> O <sub>5</sub>	0.005 - 100	XRF
Pr <sub>6</sub> O <sub>11</sub>	0.01 - 5	XRF	Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	XRF	SiO <sub>2</sub>	0.01 - 100	XRF
Nd <sub>2</sub> O <sub>3</sub>	0.01 - 10	XRF	CaO	0.01 - 100	XRF	SO <sub>3</sub>	0.005 - 5	XRF
Sm <sub>2</sub> O <sub>3</sub>	0.01 - 5	XRF	Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	XRF	TiO <sub>2</sub>	0.01 - 100	XRF
Eu <sub>2</sub> O <sub>3</sub>	0.01 - 5	XRF	K <sub>2</sub> O	0.01 - 100	XRF	LOI 1000°C	0.01 - 100	
Gd <sub>2</sub> O <sub>3</sub>	0.01 - 5	XRF	MgO	0.01 - 100	XRF			
Y <sub>2</sub> O <sub>3</sub>	0.01 - 5	XRF	MnO	0.01 - 100	XRF			
Li borate fusion			/XRF			FB1/XRF74		PGK193.10

#### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

## Ionic Leach

Rare earth elements are often contained within minerals such as xenotime and monazite, which are difficult to break down and extract the elements of interest. Rare earth elements are also often bonded to clay. The concentration of rare earths in clays are often lower but are extracted much easier through an ion exchange method. The package offered here replicates the larger scale process with an ion exchange with ammonium sulphate and subsequent analysis via ICP-MS-QQQ.

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
Ce	0.5 - 30%	MS	La	0.2 - 20%	MS	Tm	0.1 - 1%	MS
Dy	0.1 - 5%	MS	Lu	0.1 - 1%	MS	Y	0.5 - 50%	MS
Er	0.1 - 5%	MS	Nd	0.1 - 20%	MS	Yb	0.10 - 5%	MS
Eu	0.1 - 5%	MS	Pr	0.1 - 10%	MS	Sc	0.10 - 0.5%	MS
Gd	0.1 - 5%	MS	Sm	0.1 - 10%	MS			
Ho	0.1 - 2%	MS	Tb	0.1 - 2%	MS			
Ionic clay leach			/ICP first element			ICL1/MS16		PGK139.10

## 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 characterisation 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 Intertek's specialist LSI laboratory, see Minerals Trade Services.

### Specialised Copper Methods

Element	Description	Range	Code	Price
Cu	Aqua regia digest / ICP-OES	1 - 2%	Cu-AR1/OE	PGK33.50
Cu	4 acid digest / ICP-OES for more complete digestion of complex matrices	1 - 2%	Cu-4A/OE	PGK52.10
Cu	Ore grade 4 acid digest / ICP-OES	5 - 70%	Cu-4AO/OE	PGK57.60
Cu	Assay for commercial settlement (Intertek LSI)	-		POA
Cu	Multi acid digest / short iodide titration	-	Cu-VOL	PGK201.80
Cu Acid Soluble	Acid soluble copper (options available)	Various	Cu-AS/OE	PGK38.60
Cu CN Soluble	Cyanide soluble copper (options available)	Various	Cu-CN	PGK43.50
Cu Sequential	Acid soluble followed by cyanide soluble copper	Various	Cu-SQ	PGK134.50

## 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 %
Mn	0.01 - 100	Fe <sub>2</sub> O <sub>3</sub>	0.01 - 100	SiO <sub>2</sub>	0.01 - 100
Al <sub>2</sub> O <sub>3</sub>	0.01 - 100	K <sub>2</sub> O	0.01 - 100	SO <sub>3</sub>	0.002 - 15
BaO	0.01 - 10	MgO	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 - 100	P <sub>2</sub> O <sub>5</sub>	0.002 - 100	LOI 1000°C	0.01 - 100
Cu	0.005 - 5	Pb	0.005 - 5		
Li borate fusion / XRF			FB1/XRF25	PGK151.30	
Zn as an additional element			FB1/XRF25-1	PGK159.20	

### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

## Graphites

Important commodities in the battery and energy sector are not exclusively metals. Graphite is a critical component in lithium-ion batteries, acting as the anode. Intertek offers packages suitable for graphite analysis with a straight analysis for total carbon and an acid digest followed by analysis for non-carbonate carbon and graphitic carbon.

Element	Description	Detection Limit	Code	Price
C	Total carbon by CS analyser	0.01% - 50%	CSA01	PGK49.40
C non-carbonate	Weak acid digestion / CS analyser 0.01%	0.01% - 50%	C71/CSA	PGK90.00
C graphitic	Weak acid digestion, 420°C roast / CS analyser	0.1% - 40%	C73/CSA	PGK103.00
C graphitic (high-range)	Weak acid digestion, 420°C roast / CS analyser	40% - 100%	C75/CSA	PGK128.70

## Uranium

Uranium is a metallic, radioactive element which has some affinities with REE, Th, Y, Zr, Mo, Ba and Ca. It occurs in a variety of primary and secondary minerals such as oxides (uraninite, pitchblende), titanates (davidite, brannerite, absite), niobates (euxenite, fergusonite, samarskite), phosphates (torbernite, autunite, saleeite), vanadates (carnotite), silicates (coffinite, uranophane, sklodowskite), as well as carbonates, sulphates, selenites, tellurites, hydroxides, halides, arsenates, molybdates and nitrates. Most exploration programs exploit the radioactive properties of U with radiometric surveys the first step in a U exploration program, however, be aware of the limitation of such surveys. Intertek offers a wide range of analysis techniques that can be used in conjunction with the radiological surveys for the quantification of U in your samples. The package offered below is designed for the low detection limit analysis suitable for exploration samples.

### Uranium Four Acid Exploration OES & MS Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
As	0.5 - 1%	MS	K	20 - 10%	OES	Se	0.5 - 1%	MS
Bi	0.01 - 1%	MS	La	0.01 - 5000	MS	Th	0.01 - 5000	MS
Ca	50 - 40%	OES	Mo	0.1 - 1%	MS	U	0.01 - 1%	MS
Co	0.1 - 2%	MS	Ni	0.5 - 5%	OES	V	1 - 2%	OES
Cu	0.5 - 5%	OES	Pb	0.5 - 1%	MS			
Fe	100 - 50%	OES	S	50 - 5%	OES			
4 acid digest			/OES & MS			4A/OM47		PGK99.80

### Uranium Four Acid Ore Grade OES & MS Package

Element	Range ppm	Finish	Element	Range ppm	Finish	Element	Range ppm	Finish
As	10 - 20%	MS	K	200 - 20%	OES	Se	10 - 2%	MS
Bi	0.1 - 10%	MS	La	0.5 - 2%	MS	Th	0.5 - 1%	MS
Ca	100 - 50%	OES	Mo	1 - 10%	MS	U	0.5 - 30%	MS
Co	10 - 20%	MS	Ni	10 - 70%	OES	V	20 - 5%	OES
Cu	10 - 70%	OES	Pb	10 - 70%	MS			
Fe	100 - 70%	OES	S	100 - 5%	OES			
U ore grade package 4 acid digest			/OES & MS			4A/OM47		PGK107.90

### Uranium Nickel Crucible Fusion MS Package

Element	Description	Range PPM	Code	Price
U	Na peroxide fusion / MS	0.1 - 60%	FP6/MS45	PGK80.50

### Uranium Lithium Borate Ore Grade MS Package

Element	Description	Range PPM	Code	Price
U	Lithium borate fusion / MS	0.1 - 30%	FB6/MS45	PGK80.50

### Uranium Ore Grade XRF Package

Element	Description	Range %	Code	Price
U	Lithium borate fusion / MS	0.002 - 10	FB1/XRF45	PGK144.85

# 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 26.



## Ores and High Grade Materials

### 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. The use of ICP-OES and ICP-MS allows for the accurate determination of the major ore chemistry as well as the low level characterisation of the deleterious trace elements and precious metals such as Ag.

#### Ore Grade Digestion Individual Elements

Element	Range ppm	Element	Range ppm	Element	Range ppm
Ag	2 - 5000	Fe	100 - 70%	Sb	20 - 10%
Al	100 - 15%	Li	5 - 5%	Sc	5 - 1%
As	20 - 20%	Mg	100 - 60%	Sr	5 - 10%
Ba	10 - 2%	Mn	5 - 50%	Te	20 - 2%
Bi	20 - 10%	Mo	5 - 10%	Ti	20 - 5%
Ca	100 - 50%	Na	100 - 20%	Tl	20 - 2%
Cd	5 - 5%	Ni	5 - 70%	V	10 - 5%
Co	5 - 20%	P	100 - 50%	Y	5 - 1%
Cr	20 - 5%	Pb	20 - 50%	Zn	5 - 70%
Cu	5 - 70%	S	100 - 40%	Zr	5 - 2000
Ore grade 4 acid digest / ICP-OES first element / per additional element			4AO/OM	PGK58.40 PGK3.50	

## Specific Commodities

### 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 Ni and Co contents of the ore, important trace elements such as Co and Zn, 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	Sc	0.004 - 5
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 - 15
CaO	0.01 - 100	MnO	0.01 - 100	TiO <sub>2</sub>	0.01 - 100
Cu	0.005 - 5	Na <sub>2</sub> O	0.01 - 100	Zn	0.005 - 5
Cr <sub>2</sub> O <sub>3</sub>	0.005 - 10	P <sub>2</sub> O <sub>5</sub>	0.002 - 100	LOI 1000°C	0.01 - 100
Li borate fusion / XRF			FB1/XRF40	PGK128.40	

#### Legend

Complete recovery for most samples

Near complete recovery for most samples

Not complete recovery

# Individual Methods



Element	Description	Detection Limit	Code	Price
F	Carbonate fusion / SIE	50ppm	FC7/SIE	PGK109.20

### Gravimetric Determinations

Element	Description	Detection Limit	Code	Price
LOD	Loss on drying (105°C or client nominated temperature) 10g or less	0.01%	LOD/GR1	PGK48.60
LOD	Loss on drying (105°C or client nominated temperature) to constant weight 10g or less	0.01%	LOD/GR1X	PGK81.10
LOD	Loss on drying (105°C or client nominated temperature)	0.01%	LOD105_P/GR	PGK40.50 + PGK8.00/kg
LOD	Loss on drying (105°C or client nominated temperature) to constant weight	0.01%	LOD105_P/GRX	PGK81.10 + PGK8.00/kg
LOI	Loss on ignition muffle (1000°C or client nominated temperatures)	0.01%	LOI/GR	PGK33.00 per point
LOI	Loss on ignition TGA (1000°C or client nominated temperatures) Multiple temperatures each additional	0.01%	/TGA	PGK33.00 PGK8.40
BG	Bulk density / core and rocks uncoated		BG/GR	PGK51.90
BG	Bulk density / core and rocks wax coated		BGW/GR	PGK116.00
SG	Specific gravity / core and rocks uncoated		SG/GR	PGK51.90
SG	Specific gravity / core and rocks wax coated		SGW/GR	PGK116.00
SG	Pulp density (gas pycnometer method)		SGP/PYC	PGK48.60
SG	Liquid specific gravity		SGL/GR	PGK68.90

### 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.

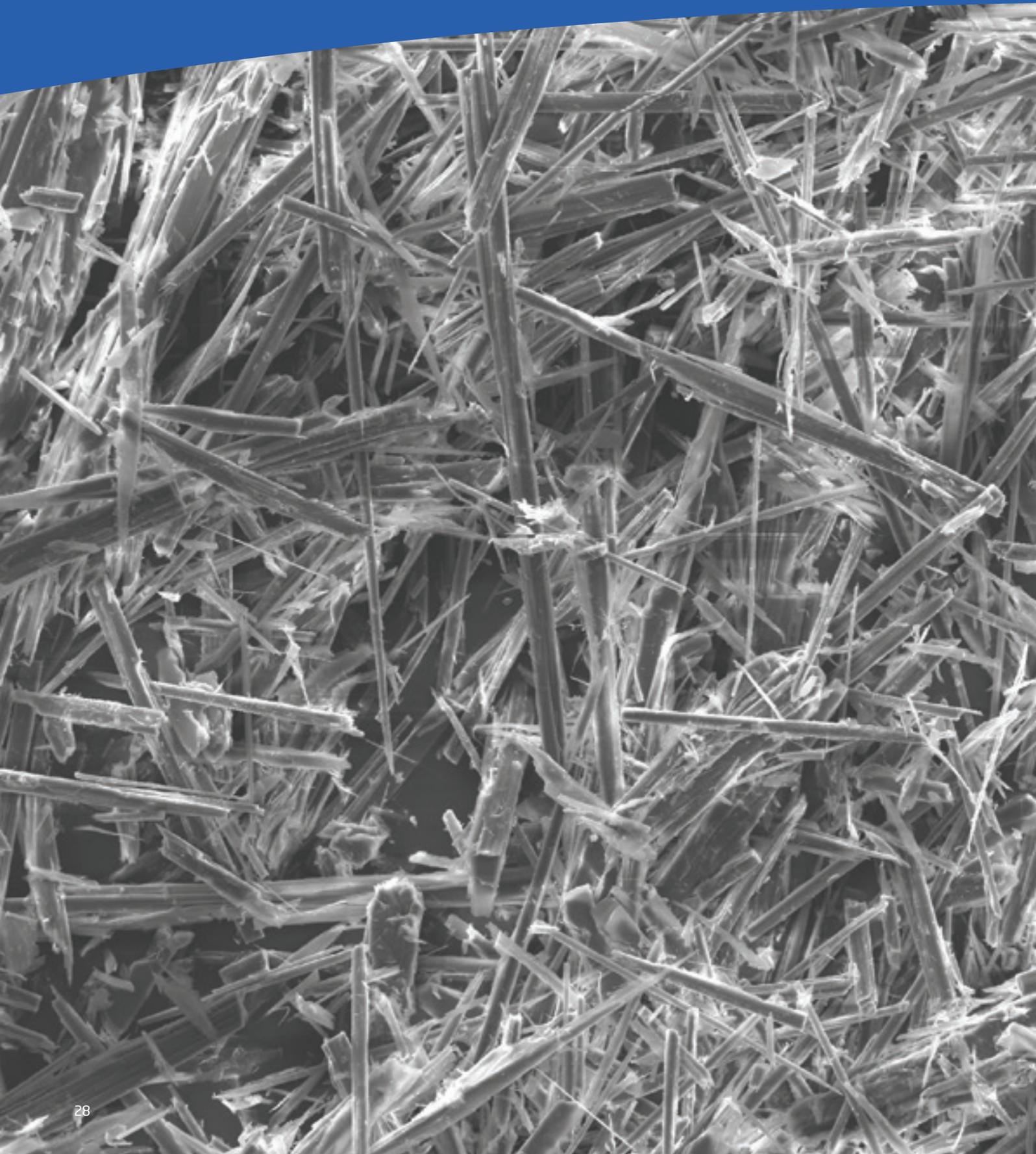
Element	Description	Detection Limit	Code	Price
C	Total carbon by CS analyser	0.01% - 50%	CSA01	PGK52.60
S	Total sulphur by CS analyser	0.01% - 50%	CSA02	PGK52.60
C,S	Total carbon & sulphur by CS analyser	0.01% - 50%	CSA03	PGK79.00
S	Sodium carbonate insoluble sulfur	0.01% - 50%	S73/CSA	PGK109.50

### Acid Rock Drainage Package

A range of tests to support prediction of acid generation of mine waste. Individual tests are available on request.

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	1kgH <sub>2</sub> SO <sub>4</sub> /t		
NAG pH	pH of oxidised solution	0.1		
C,S	Total carbon & sulphur by CS analyser	0.01% - 50%	ARD01	PGK259.70
pH	pH of 1:5 water extract	0.1		
EC	Conductivity of 1:5 water extract			
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		

# | 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 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

## 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.

## Minalyzer CS Analyzer

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 core will be scanned to pre-agreed settings and configuration by Intertek personnel and quantified with involvement from Minalyze. The core will be sent for sub-sequent analysis by the client using conventional techniques. Primary calibration will be based on pressed pellets of OREAS 24B and OREAS 624. After scanning a sub-set of the assays spanning over the range of elements and quantities will be used as a custom calibration.

### Continuous XRF Core Scanning

Scanning of core with high resolution camera as well as the LiDAR and a continuous XRF measurement along the core. There are different options of detectors, X-ray tubes and atmosphere conditions available that determine the elemental range and detection limits delivered. This enables calculation of RQD and Structural Logging through Minalogger Cloud. Standard speed is 10 mm/s and highest resolution quantified intervals would be 10cm intervals. Helium purge can be added for improved detection on lighter elements Na, Mg, Al, Si and P.

Description	Code	Price
Minalyze XRF scan	MINZ-01	PGK68.80 per meter
Minalyze XRF scan with Helium purge	MINZ-01HP	PGK76.30 per meter
Minalyze scan two settings	MINZ-02	PGK94.20 per meter
Minalyze scan two settings with Helium purge	MINZ-02HP	PGK101.80 per meter

Delivered datasets, photography, topology and elemental analysis. Enables, volume bulk density/X-SG, rock quality designation and structural logging.

### High-Resolution XRF Core Scanning

Scanning of core with high resolution camera as well as the LiDAR and a continuous XRF measurement along the core in high-resolution. There are different options of detectors, X-ray tubes and atmosphere conditions available that determine the elemental range and detection limits delivered. This enables calculation of RQD and Structural Logging through Minalogger Cloud. Standard speed is 1 mm/s and highest resolution quantified intervals would be 1 cm intervals. Helium purge can be added for improved detection on lighter elements Na, Mg, Al, Si and P.

Description	Code	Price
Minalyze high-resolution scan	MINZ-HR	PGK279.90 per meter
Minalyze high-resolution scan with Helium purge	MINZ-HRHP	PGK305.40 per meter

Delivered datasets, photography, topology and elemental analysis. Enables, volume bulk density/X-SG, rock quality designation and structural logging.

### Photography and Topology Core Scanning

This service includes scanning of core with high-resolution camera as well as the LiDAR, generating a sample photograph as well as a point cloud 3D model of the sample. This enables calculation of RQD and Structural Logging through Minalogger Cloud.

Description	Code	Price
Photography and topology	MINZ-PT	PGK63.60 per tray

Delivered datasets, photography and topology. Enables, volume bulk density/X-SG, rock quality designation and structural logging.

# 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 January 2025.

ITS (PNG) Ltd. PNG applies a processing charge of PGK83.60 per job. Maximum job size is 200 samples. Larger numbers of samples on a single submission will be split into multiple jobs.

Discounts may apply for large batches - please contact ITS PNG (Ltd) to discuss your needs.

All prices quoted in this schedule are in Papua New Guinea Kina, and exclude PNG Sales Tax.

# 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 3.468	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 1.228	CeO <sub>2</sub>	Mn	x 1.582	MnO <sub>2</sub>	Ti	x 1.668	TiO <sub>2</sub>
Co	x 1.271	CoO	Mo	x 1.500	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



Element	Atomic Number	Atomic Weight	Primary Method	Secondary Method	Other Method
Hydrogen	1	1.0079			
Lithium	3	6.941			
Beryllium	4	9.0122			
Sodium	11	22.990			
Magnesium	12	24.305			
Potassium	19	39.098			
Calcium	20	40.078			
Scandium	21	44.956			
Titanium	22	47.867			
Vanadium	23	50.942			
Chromium	24	51.996			
Manganese	25	54.938			
Iron	26	55.845			
Cobalt	27	58.933			
Nickel	28	58.693			
Copper	29	63.546			
Zinc	30	65.38			
Gallium	31	69.723			
Germanium	32	72.64			
Arsenic	33	74.922			
Selenium	34	78.96			
Bromine	35	79.904			
Krypton	36	83.798			
Rubidium	37	85.468			
Sr	38	87.62			
Strontium	38	87.62			
Cesium	55	132.91			
Ba	56	137.33			
Barium	56	137.33			
Lanthanum	57	138.91			
La	57	138.91			
Actinium	89	227			
AC	89	227			
Francium	87	223			
Ra	88	226			
Radium	88	226			
Francium	87	223			
Actinium	89	227			
Rutherfordium	104	261			
Rf	104	261			
Dubnium	105	262			
Db	105	262			
Seaborgium	106	266			
Sg	106	266			
Bohrium	107	264			
Bh	107	264			
Hassium	108	277			
Hs	108	277			
Mt	109	268			
Mt	109	268			
Darmstadtium	110	269			
Ds	110	269			
Roentgenium	111	272			
Rg	111	272			
Mercury	80	200.59			
Hg	80	200.59			
Thallium	81	204.38			
Tl	81	204.38			
Lead	82	207.2			
Pb	82	207.2			
Bismuth	83	208.98			
Bi	83	208.98			
Antimony	51	121.76			
Sb	51	121.76			
Polonium	84	209			
Po	84	209			
Polonium	84	209			
Astatine	85	210			
At	85	210			
Iodine	53	126.90			
I	53	126.90			
Tellurium	52	127.60			
Te	52	127.60			
Sulfur	16	32.065			
S	16	32.065			
Chlorine	17	35.453			
Cl	17	35.453			
Fluorine	9	18.998			
F	9	18.998			
Oxygen	8	15.999			
O	8	15.999			
Nitrogen	7	14.007			
N	7	14.007			
Carbon	6	12.011			
C	6	12.011			
Boron	5	10.811			
B	5	10.811			
Helium	2	4.0026			
He	2	4.0026			

Cerium	58	140.12			
Ce	58	140.12			
Praseodymium	59	140.91			
Pr	59	140.91			
Neodymium	60	144.24			
Nd	60	144.24			
Promethium	61	145			
Pm	61	145			
Samarium	62	150.36			
Sm	62	150.36			
Europium	63	151.96			
Eu	63	151.96			
Gadolinium	64	157.25			
Gd	64	157.25			
Terbium	65	158.93			
Tb	65	158.93			
Dysprosium	66	162.50			
Dy	66	162.50			
Er	68	167.26			
Er	68	167.26			
Ytterbium	70	173.05			
Yb	70	173.05			
Lu	71	174.97			
Lu	71	174.97			
Thulium	69	168.93			
Tm	69	168.93			
Uranium	92	238.03			
U	92	238.03			
Protactinium	91	231.04			
Pa	91	231.04			
Thorium	90	232.04			
Th	90	232.04			
Neptunium	93	237			
Np	93	237			
Plutonium	94	244			
Pu	94	244			
Americium	95	243			
Am	95	243			
Curium	96	247			
Cm	96	247			
Berkelium	97	247			
Bk	97	247			
Californium	98	251			
Cf	98	251			
Einsteinium	99	252			
Es	99	252			
Fermium	100	257			
Fm	100	257			
Mendelevium	101	258			
Md	101	258			
Nobelium	102	259			
No	102	259			
Lutetium	71	174.97			
Lu	71	174.97			
Lawrencium	103	262			
Lr	103	262			
Ununseptium	117	Uus			
Uus	117	Uus			
Ununhexium	116	Uuh			
Uuh	116	Uuh			
Ununpentium	115	Uup			
Uup	115	Uup			
Ununquadium	114	Uuq			
Uuq	114	Uuq			
Ununtrium	113	Uut			
Uut	113	Uut			
Thallium	81	204.38			
Tl	81	204.38			
Lead	82	207.2			
Pb	82	207.2			
Bismuth	83	208.98			
Bi	83	208.98			
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N	7	14.007			
Carbon	6	12.011			
C	6	12.011			
Boron	5	10.811			
B	5	10.811			
Helium	2	4.0026			
He	2	4.0026			

# Intertek Minerals Services Terms and Conditions (2024)

- 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

### Papua New Guinea

#### LAE Laboratory

Tel: +675 472 8113 | Email: min.png.lae@intertek.com

### Australia

#### Intertek Minerals

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

Tel: +86 22 2532 7795 | Email: roy.zhang@intertek.com

#### Urumqi Sample Preparation Facility

Tel: +86 1509916 7729 | Email: hongchang.wang@intertek.com

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