CSA Global has been using field portable XRF (pXRF) technology successfully in the resource industry for over ten years in mineral exploration, grade control and environmental applications. Our expertise in this field allows us to provide program design, data capture, interpretation of results and data management solutions for our clients as well providing pXRF units for hire.

CSA Global's data collection, data management and GIS expertise provides an ideal platform to deliver support for training and ongoing assistance of pXRF programs to the minerals, petroleum and environmental industries. CSA Global has expert staff dedicated to pXRF program design and management and to assist with any technical enquiries or the rental requirements you may have for a pXRF instrument.

XRF is a well-established laboratory technique for elemental analysis used all over the world. Recent advancements in this technology have allowed field portable XRF analysis at geochemical concentrations useful to the exploration geologist or environmental scientist.

CSA Global uses pXRF units to assist miners, geologists and environmental scientists to save time and money by implementing on-site analytical programs. The units are highly versatile and able to analyse elements in solids, liquids, powders, cores, fragments, filters & films, and slurries.

Public reporting of pXRF data requires a good understanding of the limitations and pitfalls associated with the use of the technology. The reported data must meet the standards required under various international reporting codes and requires sign-off by a geoscientist competent in the use of the equipment. CSA Global can assist by providing the necessary preparation and training.

CSA Global also offer a broad range of contract geochemical services to our clients including orientation surveys, mapping, drill sample analysis, grade control, baseline studies and environmental monitoring. Given our expertise in geology we are able fully integrate the results with geological understanding.

**pXRF PRACTICAL FIELD SOLUTIONS**

**Applications in Exploration:**
- **Geochemical exploration** - orientation, reconnaissance, or grid geochemical surveys – real-time detection of anomalies, no need to wait for lab results to carry out infill surveys.
- **Mapping** – regolith and outcrop mapping for real-time alteration and rock identification.
- **Drilling** – auger, RAB, aircore, RC, rotary cuttings, diamond - in field analysis direct from the sample, instant results and screening of samples sent for laboratory analysis.

**Applications in Mining:**
- **Mapping** – in pit or underground - obtain real time data at low cost and improve definition of ore waste boundaries and alteration haloes.
- **Grade control** – analysis of grab, channel, blast hole, RC and dump samples – low cost allows greater density of measurements, instant data provides greater flexibility in mine planning.
- **Geometallurgy** – multi-element analysis for input into flow sheets allowing real time refinement of processes.

**Applications in Environmental Studies:**
- **Baseline studies** – increase the density of sampling for the same cost.
- **Contaminated sites assessment** – ability to analyse surface exposures (insitu samples) reduces the dilutionary effects of whole sample analysis.
- **Environmental monitoring** – real-time results, allow earlier hazard identification and faster response time.
PORTABLE XRF SCHEDULE OF CONSULTING SERVICES

FIXED FEE SERVICES

1. ORIENTATION DATA REVIEW
Purpose - to establish pathfinder element suites and/or lithogeochemical signatures for pXRF programs specific to a particular project.
Requirements - requires multi-element data relevant to XRF analyses and information on the project. The data must be in digital format and have been merged with relevant sample information where available.
Deliverable – summary memo identifying suitable elements for portable XRF analysis as pathfinders or as indicators of hydrothermal alteration, including relevant threshold levels.

2. STANDARD OPERATING PROCEDURE (SOP – UN-CALIBRATED)
Purpose – to provide a SOP tailored to the operation of a specific pXRF analyzer for a particular project, excluding calibration of the instrument.
Requirements – requires information on the specific analyzer to be used, the elements of interest (either commodity or established through orientation) and project details.
Deliverable – SOP document including equipment set-up, operating conditions and QAQC protocols, as well as recommendations on suitable matrix-appropriate standards to be used.

3. QAQC REVIEW
Purpose – to summarize the performance of a pXRF analyzer for key elements relevant to the project.
Requirements – digital quality control data for standards, blanks and duplicate analyses obtained during the course of field data capture.
Deliverable – memo summarizing data quality and including recommendations for improvement as required.

4. WELLSITE PXRF SERVICES
Speak to our sales representatives or contact dennis.arne@csaglobal.com about fixed price services for petroleum well site pXRF analyses, including analyzer calibration, normative mineralogy & TOC estimation, quantitative XRD mineralogy and SOPs.
CSA GLOBAL XRF CONSULTANCY SERVICES

First point of client contact

Consulting services requested

NO

ORIENTATION

Work with client to analyze representative samples for review or establish from appropriate literature Quotation

NO

Orientation geochemical data available

YES

Statistical review of existing data to establish pathfinder elements and/or lithogeochemical signature. Fixed price

Standard operating procedures (SOPs), including QAQC protocols & standards.

ACCURACY

Uncalibrated SOP required. Matrix-matched standards or project-specific standards used for QAQC. Fixed price

NO

Accurate XRF data required (i.e. grade control or environmental assessment)

YES

Calibrated SOP required using matrix-matched standards or project-specific standards. Standards also used for QAQC. Quotation

ADDITIONAL CONSULTING MODULES

Ad hoc consulting and analysis Quotation

Sampling project management +/- sampling crew Quotation

XRF data management services in Access or DataShed Quotation

Interpretation of XRF data Quotation

Review and memo on FPXRF QAQC data Fixed price

On-site training required. 2 days + travel & expenses Quotation

Rental only—no immediate involvement by CSA Global
We draw on our collective experience to customise exploration and mining solutions to each client’s requirements. Our advice and services are tailored to respond to the individual advantages and constraints of each geographical region.

We have worked with all sizes of companies from small businesses to international majors, as well as with governments and NGO’s. We make it our business to get to know and understand the region’s cultural diversity, political background, sovereign risk, workforce and technical capability. We identify with each region’s approach to sustainability and its level of support for our industry.

**About CSA Global**

We are a leading mining, geological, technology and management consulting company with more than 30 years experience in the international mining industry. We cover all stages of the exploration and mining cycle, including mineral commodities and extraction methods across all regions:

**CORPORATE**
- Project reviews
- Due diligence
- Expert valuations
- Independent reports
- Geo-corporate advice
- Secure information hosting (Spring portals & data rooms)

**EXPLORATION**
- Mineral systems targeting & project generation
- Remote sensing & geophysics
- Geochemistry (traditional & non-destructive methods)
- Mapping & field investigations
- Drill program planning & supervision
- Exploration strategy & project management

**MINING**
- Mining & engineering studies (concept to feasibility)
- Reserve assessment reviews
- Mine optimisation, scheduling & design
- Ore Reserve estimation & reporting
- Grade control & reconciliation
- Productivity improvement & project management

**TECHNOLOGY**
- Data management (capture, data warehousing & QAQC of data)
- Data visualisation, analytics & cartography
- GIS plans, sections & 3D plots
- IT Management (health reporting, auditing, cyber security advice)
- Project design & management (Cloud systems design, infrastructure design & implementation)
- Mining specialist IT Helpdesk

**RESOURCES**
- Review of data collection techniques & QAQC of data
- Geological & geo-metallurgical modelling
- Geostatistical analysis & variography
- Mineral Resource estimation, validation & classification
- Resource reporting in accordance with international codes
- Resource audits & risk analysis

CSA Global Head Office
Level 2, 3 Ord Street
West Perth, WA 6005
T +61 8 9355 1677
E info@csaglobal.com

www.csaglobal.com