## SCOPE

On-line analysis of gold in impregnated stripping solutions during the electrowinning process is demonstrated.

BACKGROUND

Gold ore processors commonly utilize the cyanide leaching technique to recover trace gold content. After the gold is leached out of the ore, it is typically absorbed onto activated carbon in processes such as Carbon-in-Pulp (CIP), Carbon-in-Leach (CIL), or Carbon Column (CC). Once absorbed, the gold is stripped from the Carbon and the impregnated stripping solution fed into the electro winning process where the gold is recovered by electrolysis. By measuring the gold in the stripping solution real-time, operations can trend when the solution will be barren of gold significantly improving the plant's efficiency. The Rigaku NEX OL offers a simple and low maintenance on-line analytical technique for trending such solutions. Results are communicated to your plant DCS (distributed control system) via 4-20 mA current loops or MODBUS over Ethernet connection allowing for real time closed loop control.
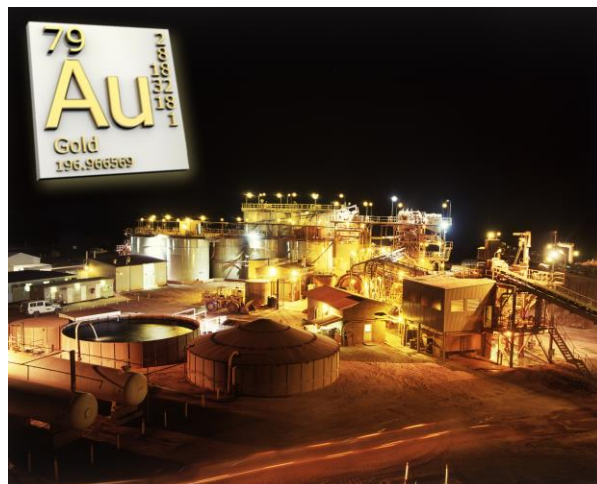
INSTRUMENTATION

Model:	Rigaku NEX OL Analyzer
Excitation:	Direct with filters
X-ray tube:	4 W Ag-anode
Detector:	Silicon Drift Detector

Total Measurement Time = 240 sec

SAMPLE PREPARATION

Gold strip solutions samples were used, with assay values provided by AA. No sample preparation treatment is required. All samples were measured in a static position using the auxiliary sample input loop.

UNIT CONVERISION

The simple conversion shown here is made without conversion for relationship between volume of liquid solution to volume of ore material.
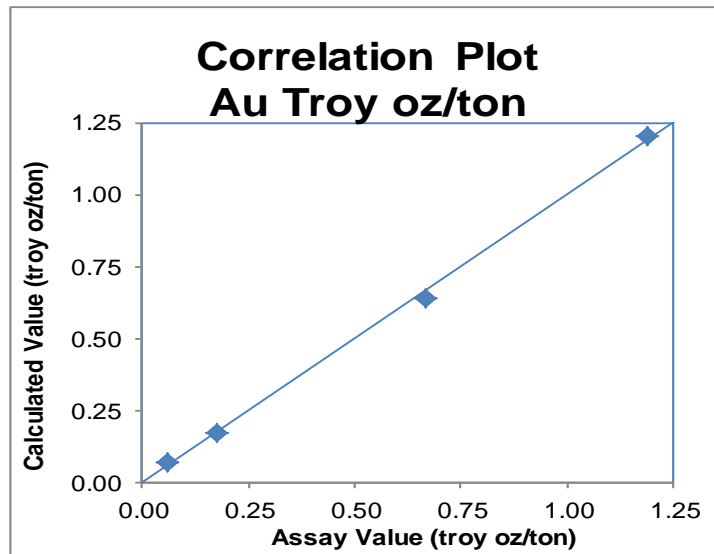
1 troy oz/ton = 34.3 ppm
1 ppm = 0.029 troy oz/ton

CALIBRATION

A simple linear empirical calibration was built using a suite of 4 calibration standards assayed by AA. Calibration can be made in units of ppm or troy oz/ton.

Element: Au SEE: 0.019		
Units: troy oz/ton R^2: 0.9989		
Sample ID	Assay Value	Calculated Value
2	0.058	0.067
6	0.174	0.174
23	0.667	0.638
41	1.189	1.204

Element: Au SEE: 0.66 ppm		
Units: ppm Correlation: 0.9989		
Sample ID	Assay Value	Calculated Value
2	2.0	2.3
6	6.0	6.0
23	23.0	22.0
41	41.0	41.5
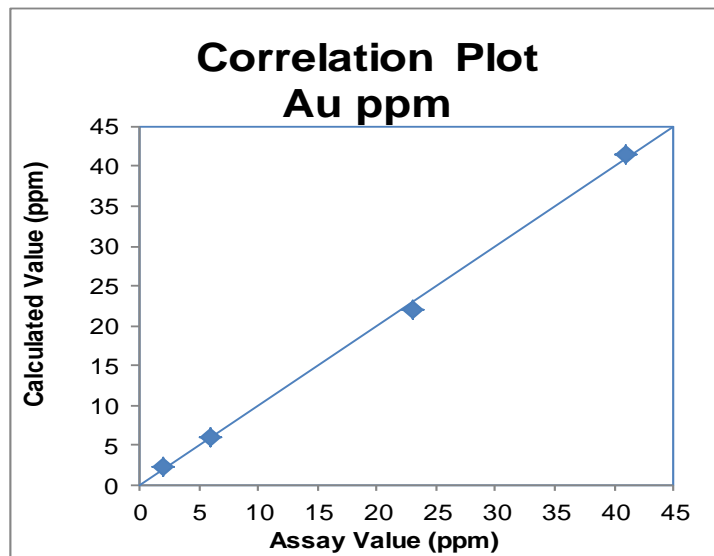
PRECISION

Instrument repeatability (precision) is determined by ten repeat analyses of a sample in static position using a 240 sec measurement time per analysis. Precision results are summarized here.

Element: Au	Units: troy oz/ton		
Sample	Standard Value	Average Value	Std Dev
6	0.174	0.145	0.012
23	0.667	0.632	0.020

| Element: Au	Units: ppm		
Sample	Standard Value	Average Value	Std Dev
6	6.0	5.0	0.4
23	23.0	21.8	0.7

DETECTION LIMIT

Ten repeat analyses of a DI water sample containing no Au were taken with the sample in static position, and the standard deviation was determined. The Lower Limit of Detection (LLD) is then defined as three times the standard deviation.

Element	Empirical LLD Troy oz/ton	Measurement Time
Au	0.044	240 sec

Element	Empirical LLD ppm	Measurement Time
Au	1.5 ppm	240 sec

NEX OL FEATURES & BENEFITS

- Real-time process control
- Trend analysis charting
- Capable of measuring elements Al to U, depending on application
- 50 kV X-ray tube excitation source with high resolution and count rate Si Drift Detector (SDD) technology
- Industrial touch screen user interface
- Unique tool less flow cell design
- 4-20 mA or MODBUS over Ethernet results reporting
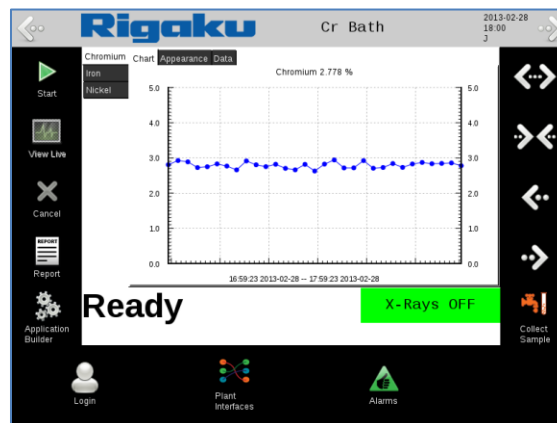
CONCLUSION

The NEX OL offers real time trend analysis in a simple yet powerful and versatile system for quantifying the elemental composition of a process stream. The results of this study indicate that given stable samples, proper sample handling and proper calibration technique, the Rigaku NEX OL EDXRF can achieve excellent results in monitoring the concentration of gold strip solutions as part of the electro winning process.