CNSolution™ 9310 On-line Cyanide Analyzer

O·I·Analytical
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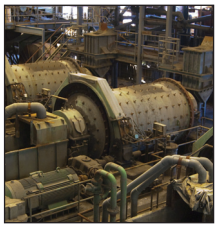
CNSolution ™ 9310

Accurate Measurement of Cyanide in Leaching Solutions



Accurately measuring cyanide available for leaching precious metal ores containing copper and metallic sulfides is problematic. Copper complexes with cyanide reducing the cyanide available for leaching. Titration methods commonly used for process control in gold leaching poorly estimate the amount of cyanide available when copper is present [1]. Other reaction products, including thiocyanate, nitrate, nitrite, ammonia, and sulfur (IV) oxides interfere with most cyanide analysis methods [2].

The OI Analytical CNSolution™ 9310 On-line Cyanide Analyzer is designed to measure available cyanide in precious metal leaching solutions by U.S. EPA Method OIA-1677 [3] and ASTM D 6888-09 [4]. The gas-diffusion amperometry technique in these methods has been demonstrated to be free of interferences from copper and metallic sulfides in precious metal leaching solutions. [5]

On-line monitoring with the CNSolution 9310 enables gold and silver mills to reduce cyanide consumption and operating costs associated with the cyanidation process.

[1] *Cyanide Measurement and Control for Complex Ores and Concentrates, P.L. Breuer, and J.A. Rumball, Ninth Mill Operators Conference, Fremantle, WA, March 19-21, 2007.*

[2] *ASTM D 7365-09 Standard Practice for Sampling, Preservation and Mitigating Interferences in Water Samples for Analysis of Cyanide, ASTM International, 2009.*

[3] *Method OIA-1677 Available Cyanide by Flow Injection, Ligand Exchange, and Amperometry, EPA-821-R-99-013; U.S. Environmental Protection Agency, August 1999.*

[4] *ASTM D 6888-09 Standard Test Method for Available Cyanide with Ligand Displacement and Flow Injection Analysis (FIA) Utilizing Gas Diffusion Separation and Amperometric Detection, ASTM International, 2009.*

[5] *Rapid Distillationless "Free Cyanide" Determination by a Flow Injection Ligand Exchange Method, Environmental Science and Technology, Vol. 29 No. 2, 426-430, 1995.*

The CNSolution 9310 supports measurement and control of cyanide in multiple cyanidation unit operations as shown in this process diagram.

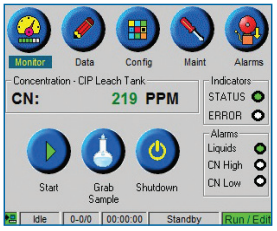
1. **Cyanide Addition**
2. **Leaching**
3. **Cyanide Recycle**
4. **Detoxification**
5. **Effluent Discharge / Tailings**

Reliable Data for Process Control

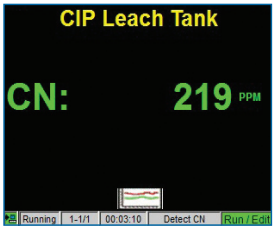
In operation, a filtered slurry sample is drawn into the CNSolution 9310 to fill a fixed volume loop. A base reagent is continuously pumped through one side of a gas diffusion module equipped with a hydrophobic membrane and out through the flow cell of an amperometric detector.

Sample in the loop is injected into an acidic carrier stream. The acidic conditions convert CN^- in the sample to hydrogen cyanide (HCN) gas which diffuses across the hydrophobic membrane into the base reagent where it converts back to CN^- and enters the flow cell of the amperometric detector. Cyanide ions react with the silver electrode and generate a current proportional to the cyanide concentration. The detector response for each sample is displayed in real-time as a peak on the touch-screen display and can be output to a Supervisory Control and Data Acquisition (SCADA) system.

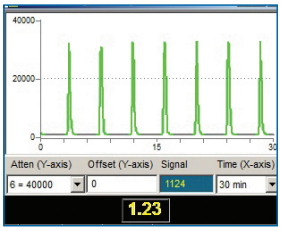
Data can be output to a LAN network in a Microsoft® Excel® – ready .csv format or retrieved using a USB memory stick.



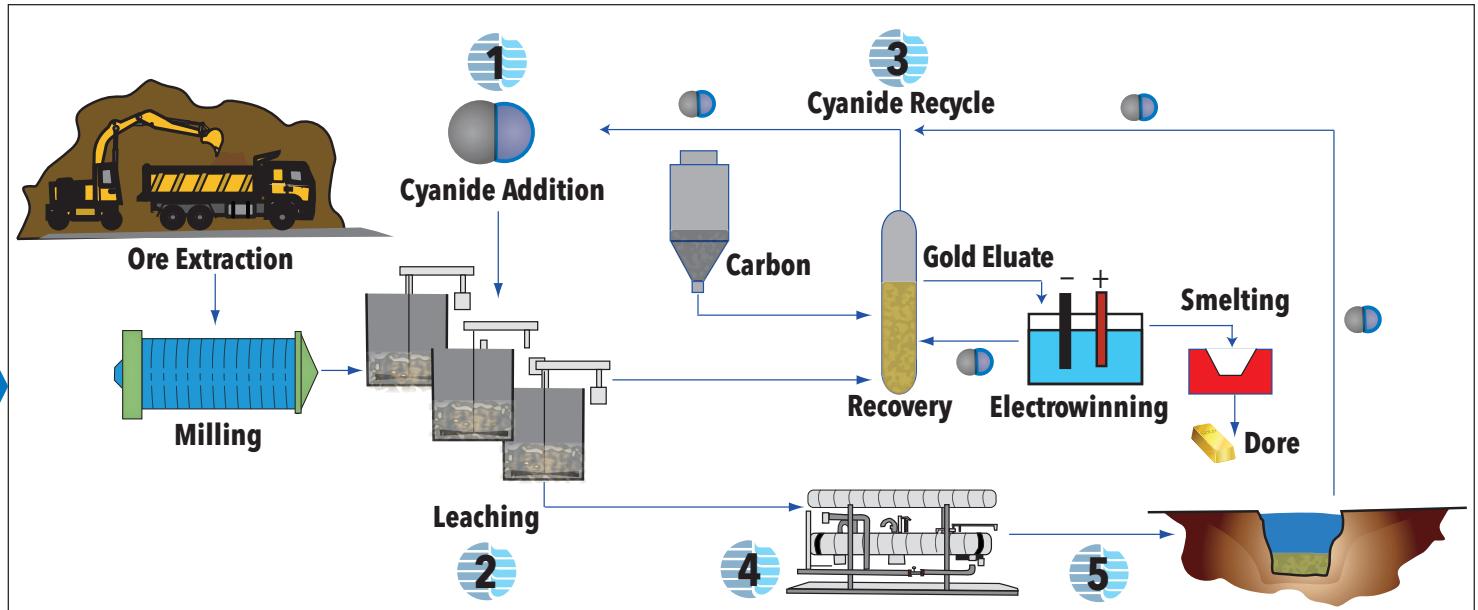
Start/Edit Screen



Run Screen



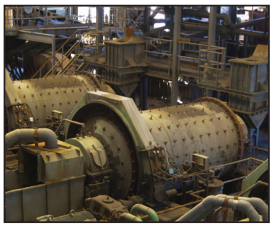
Detector Response



CNSolution™ 9310 Deployment in Precious Metal Cyanidation

CNSolution™ 9310 Specifications

Operating Principle	FIA by gas diffusion amperometry
Measurement Technique	Amperometric detection – silver electrode
Measurement Ranges	0.2 to 50 / 2.0 to 500 / 20 to 2000 ppm CN
Reference Methods	USEPA OIA-1677 / ASTM D 6888-09 (Available CN)
Calibration	2 point calibration
Measurement Accuracy	± 5% at 50-ppm
Sample Introduction	Continuous on-line fill-and-spill sampling system
Sampling Interval	User programmable
Analysis Time	<3 minutes
Operating Environment	5 – 45 °C, up to 90% humidity (non-condensing)
Operator Interface	Windows® CE-based, Color touch-screen display
Reagents Required	Water, NaOH, HCl, CN^- calibration standards
Power Requirements	$24V_{DC}$
Output Relays	2 (system alarm, sample alarm)
Analog Output	2 4-20mA (user-configurable concentration)
Data Export	To PC via Ethernet, or using USB memory stick
Instrument Enclosure	NEMA 4X / IEC Class IP-56
External Dimensions	48.3 cm H x 31.1 cm W x 31.1 cm D (19 " H x 12.25 " W x 12.25 " D)
Weight	11 kg (24 lbs.)
Certifications	CE

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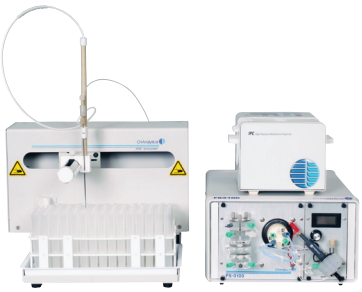
CNSolution™ 3100 Laboratory Cyanide Analyzer



The CNSolution™ 3100 Laboratory Cyanide Analyzer performs the same gas-diffusion amperometry technique used in the CNSolution™ 9310 for calibration checks and confirmatory testing of grab samples.