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BLUE CUBE MQi Hydromet

In-line Cu [ppm] measurement and zinc dust dosing control

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1 Introduction

A Blue Cube MQi Hydromet unit has been installed at a Zinc Refinery to measure and control the copper concentration in the cementation process. This process serves as a bleed-off to prevent a built-up of Cu, Ni and Co in the main circuit.

The copper concentration is measured real-time to effectively control the zinc dust dosing rate. The MQi has a significant financial benefit as it eliminates overdosing of the expensive high grade zinc dust.

Illustration 1: Blue Cube MQi Hydromet unit

2 Description of the zinc leaching circuit.

In illustration 1 below, a flow diagram of the refining process is shown:

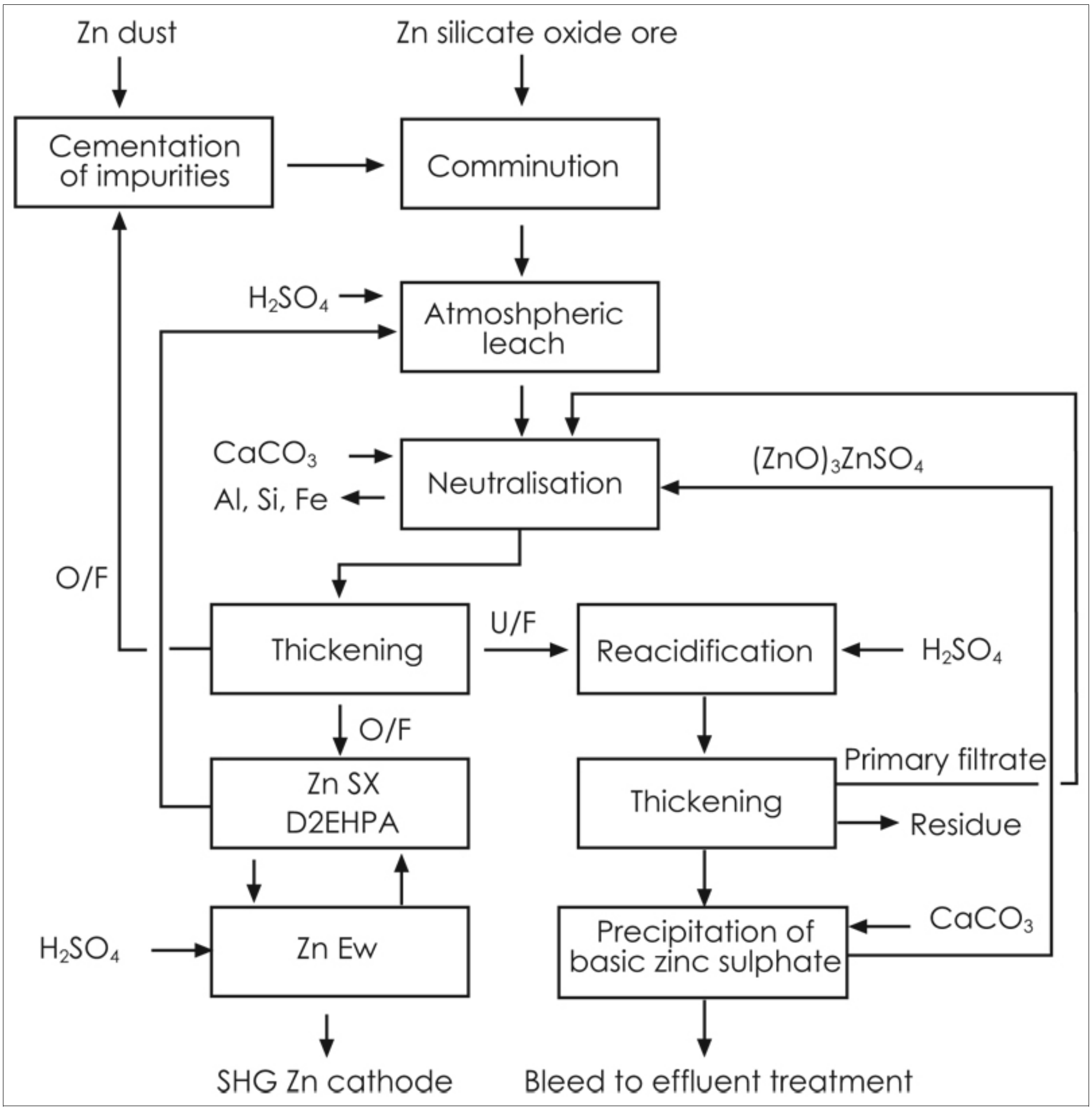

Illustration 2: Zinc Refining Process

In the zinc refining process the milled and thickened ore product from comminution is sent to a leaching circuit.

The ore is leached directly in dilute Sulphuric acid to produce Zinc Sulphate. It is not possible to directly electrowin Zinc from the sulphate solution due to the high Chlorine and Fluorine levels and other impurities contained in ore.

The high Chlorine and Fluorine levels cause anode and cathode corrosion and cathode stripping problems.

Solvent extraction provides a buffer against chlorine and fluorine and effectively prevents any carry-over into the purified electrolyte solution.

Copper and Nickel are not co-extracted with Zinc during solvent extraction and are recycled back to the leach circuit. This cause a build-up of Copper and Nickel concentrations in the circuit. To lower the Cu and Nickel concentration in the circuit a section of the pregnant leach solution (PLS) is bleed from the circuit and the Cu and Nickel removed from this section.

Copper, Nickel and Cobalt removal are done through cementation with metallic Zinc dust.

Traditionally, cementation with Zinc dust has been used to remove these impurities to levels acceptable for Zn electrowinning. Illustration 3 provides a schematic of the cementation process.

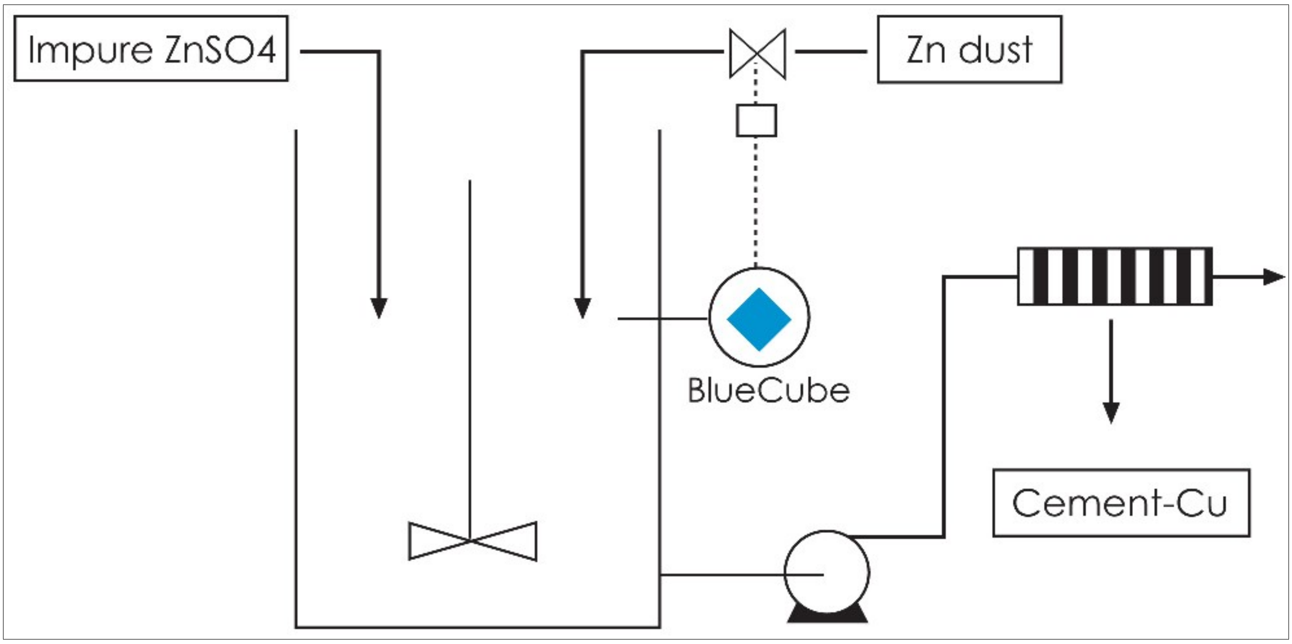

Illustration 3: Schematic of the cementation process.

In this case it is not necessary to achieve very low levels of these impurities in zinc dust cementation as the only function of the cementation step is to provide a bleed and not to produce solution of acceptable quality for electrowinning – this is done by the solvent extraction circuit.

It is however, necessary to produce solution with a relatively low level of copper to limit copper cementation onto mill steel and the corresponding accelerated corrosion of mill steel.

The process produces a Copper depleted solution (less than 50mg/l), which is recycled to the milling circuit, and a metallic Copper/Nickel/Cobalt filter cake.

3 Description of the the Blue Cube MQi measuring apparatus

The purpose of this instrumentation is to measure the metal ion concentrations in solution at the various measuring points in hydro metallurgical processes.

For liquid samples, (mineral components in solution) diffuse transmission spectroscopy is used. In this case, the light penetrating through the solution is captured and processed.

For in-line applications, a sample is withdrawn from the process stream, piped through the Blue Cube MQi In-line Hydromet scanner, and returned to the process.

Illustration 4 below shows a schematic representation of the Blue Cube MQi components.

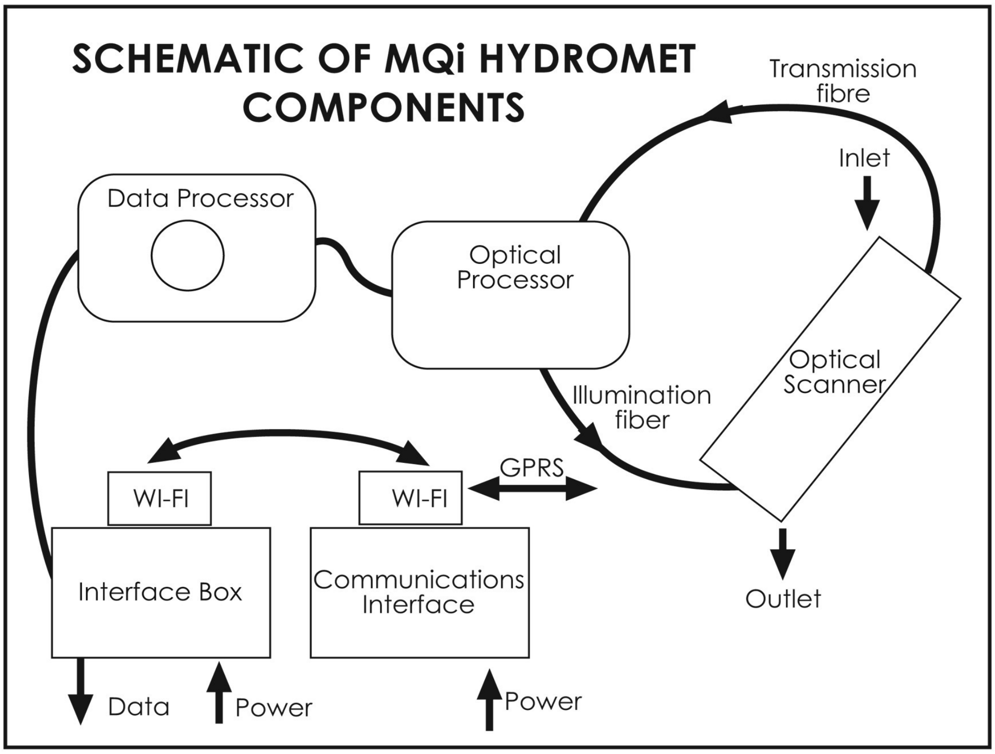

Illustration 4: Schematic of the Blue cube MQi instrumentation.

4 Calibration:

4.1 First Calibration : 05 - 08 August 2008

Figure 1 shows the calibration model fit for Cu after the first calibration.

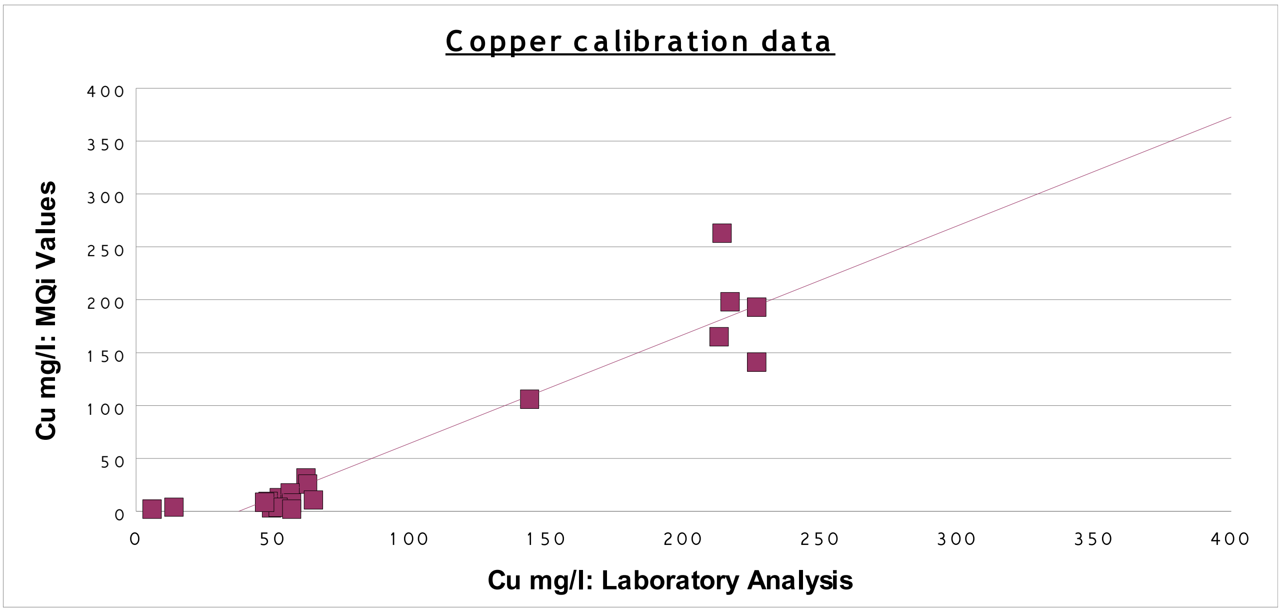

Figure 1: Calibration model fit after first calibration.

4.2 Second Calibration 19 August 2008

Figure 2 shows the calibration model fit for Copper after the second calibration.

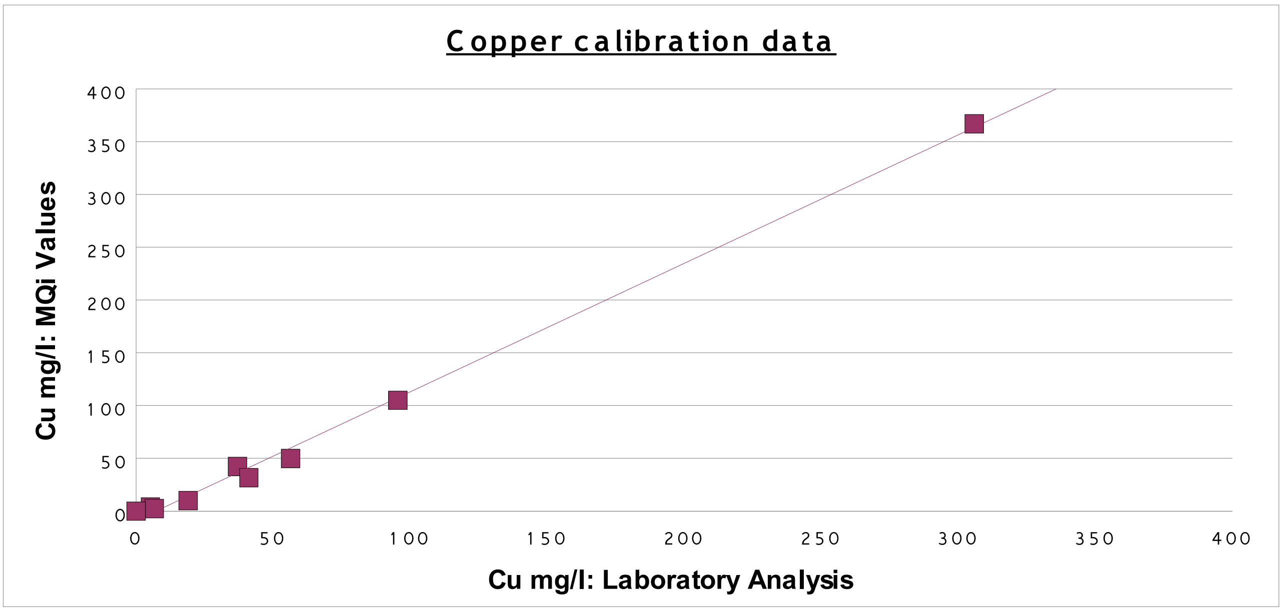

Figure 2: Calibration model fit after second calibration.

4.3 Independent qualification : 05 September 2008

The calibration set was tested with samples not used for calibration, thus independent qualification samples. Figure 3 below shows the Blue Cube values for Copper against the laboratory analysis. The R square for the data can be calculated and is an indication of the accuracy achieved for Copper.

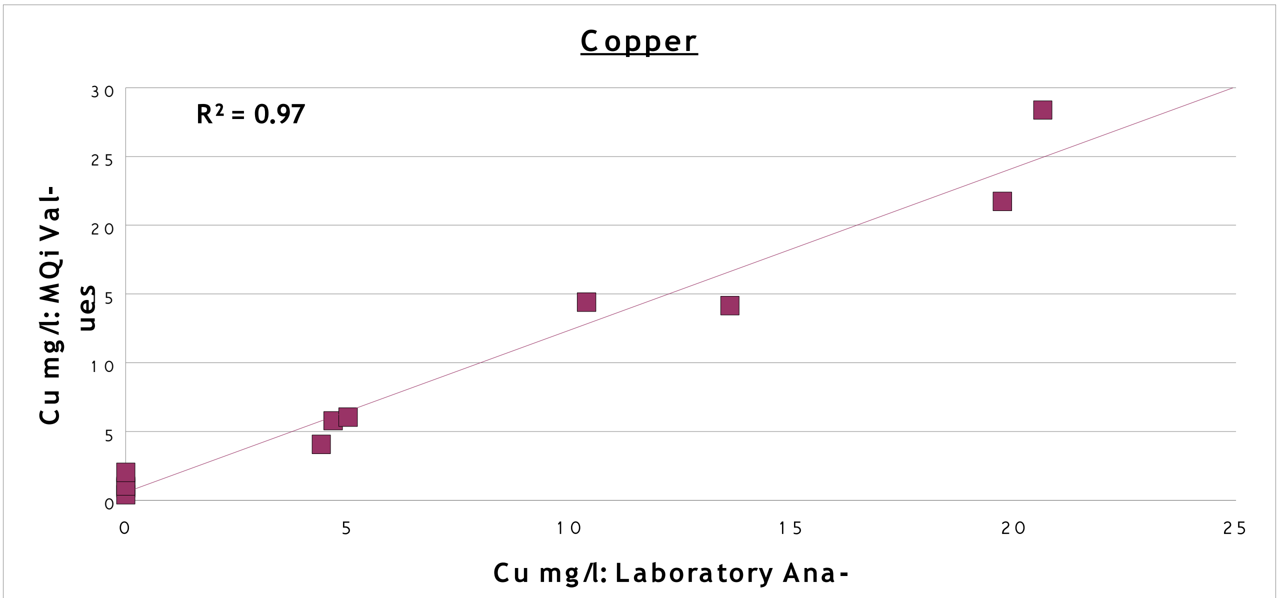

Figure 3: Independent qualification data.

Figure 4 below shows the calibration samples and the subsequent improvement from the first calibration to the third. After evaluation the independent qualification data where also included in the calibration set.

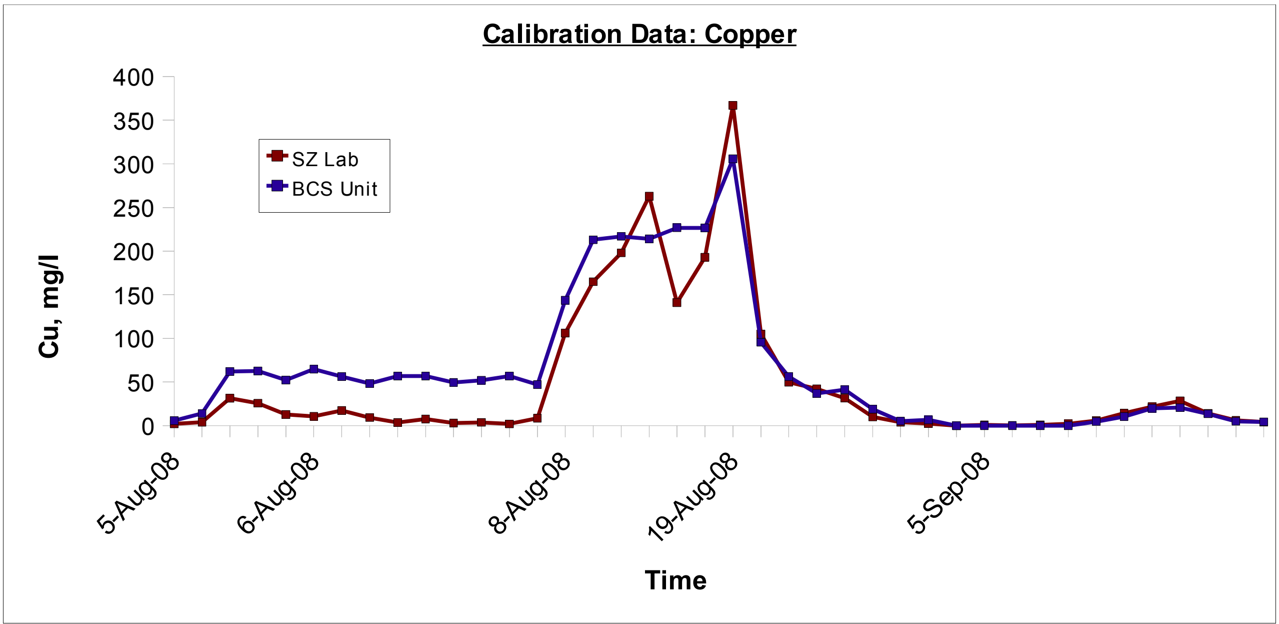

Figure 4: Calibration improvement over time.

5 Qualification test

5.1 System response

The following test work demonstrates the response of the system to a particular input.

The test work was done on the 5th of September 2008 and the data in the graph below shows the Copper contents and Zinc dust dosing rates from 11:29 am to 16:29 pm.

The following changes where made:

1. The zinc dust dosing rate was decreased and the subsequent increase of the Cu concentration is measured and reported in real time.
2. The dosing rate is lowered a second time. The Cu concentration now rapidly increase with time.
3. The dosing rate is increased and the subsequent drop in Cu concentration is measured and reported.
4. The dosing rate is lowered again, consistently effecting a rise in Cu concentration.

Control samples were taken for laboratory analysis to verify the results.

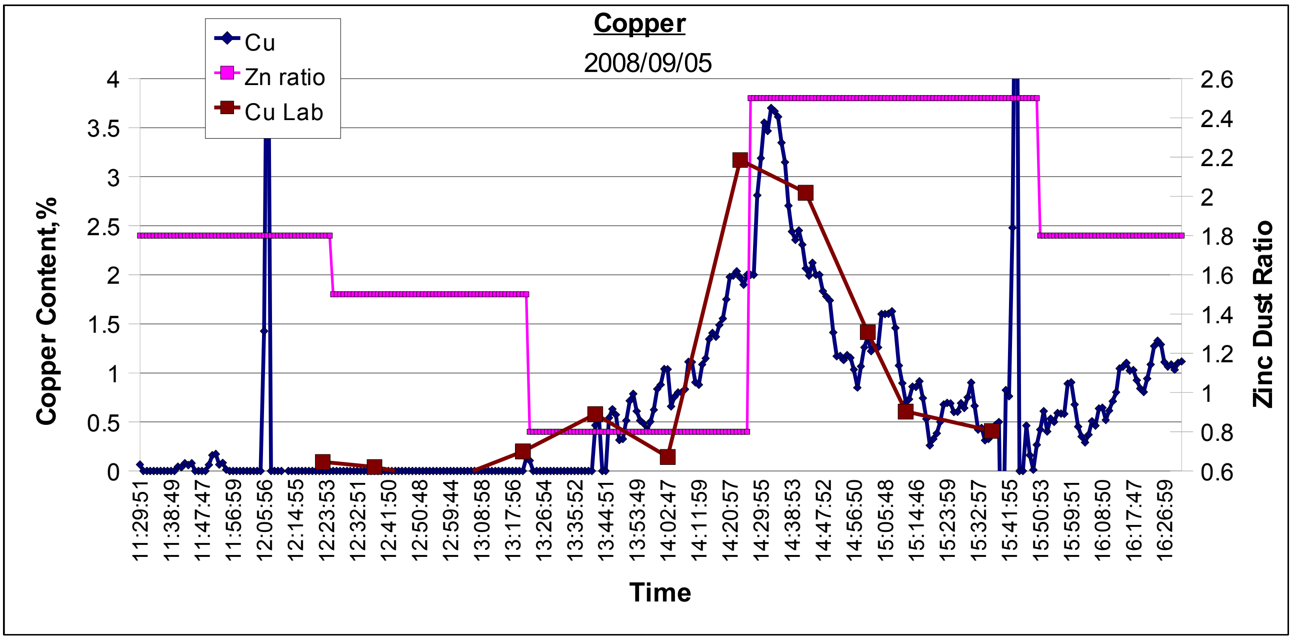

Figure 5: Zinc dust dosing rate vs Copper concentration.

6 Automatic Zinc dust dosing rate control

The zinc dust dosing is controlled by adjusting the open time of the dosing valve.

The Cu concentration is measured real-time by the Blue Cube instrument and the stoichiometric required zinc dust is calculated.

A minimum Cu concentration of 50 mg/l is the target concentration for the filtrate to avoid over dosing.

6.1 Demonstrate the advantages of control.

Figure 6 below shows the valve opening time per day from September to November 2008. The three periods market in dotted blue shows the time periods during which the Blue Cube where used for control. It is apparent that the consumption of zinc dust was low when the Blue Cube was operational.

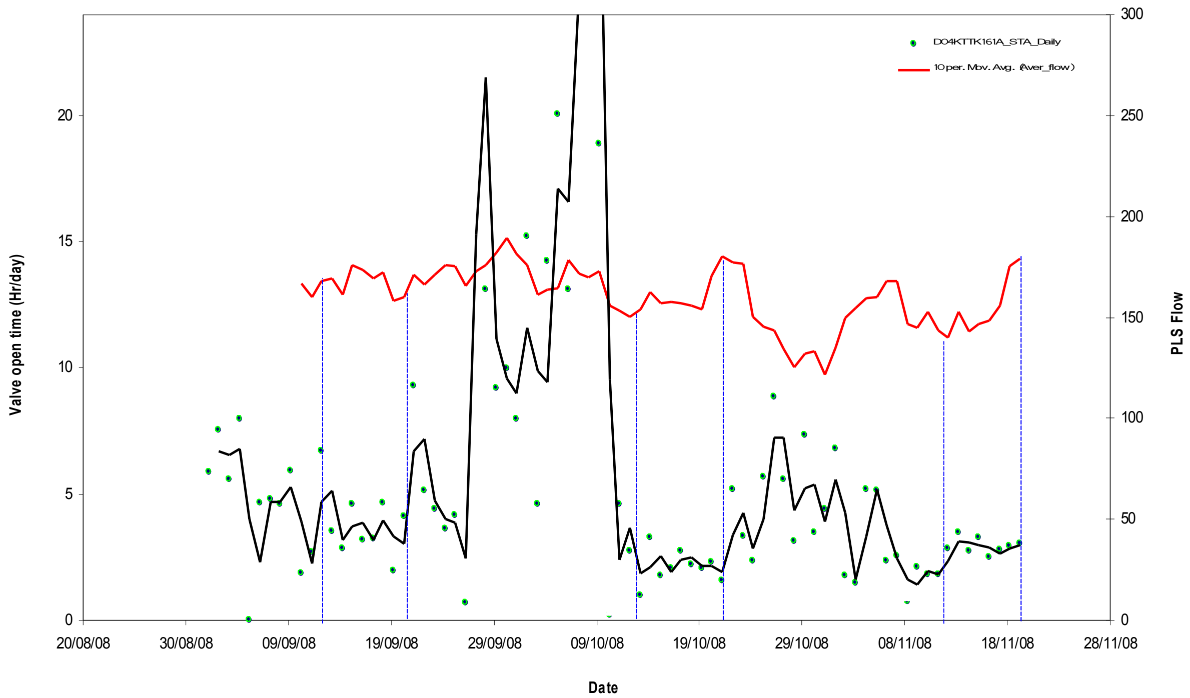

Figure 6: Valve opening time per day from September to November 2008

The benefit of the MQi is magnified if a longer period is considered. Figure 7 captures the valve opening time of the Zn dust addition over the period March to November 2008.

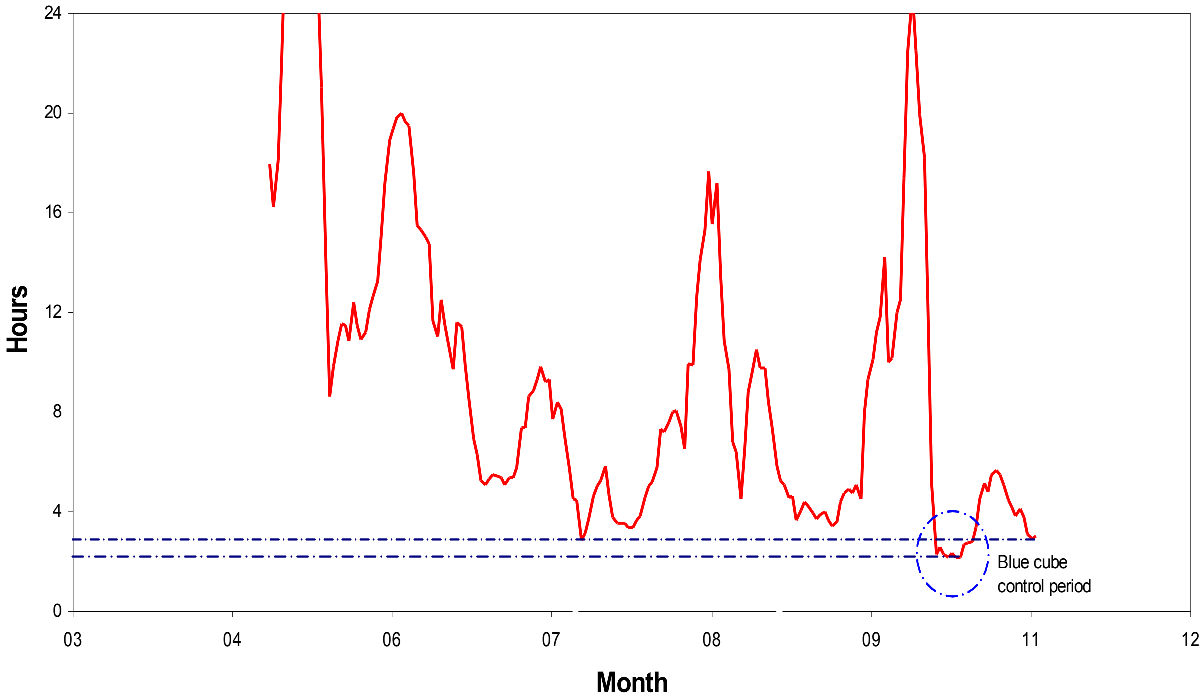

Figure 7: Valve opening time per day from April to November 2008

7 Conclusions

The MQi Hydromet is a safe, robust tool that effectively quantifies metal ion concentrations in real-time.

The copper concentration is measured to effectively control the zinc dust dosing rate in the cementation process. This has resulted in significant savings due to the reduction in zinc dust consumption.

The system can be implemented as an on line gate keeper to ensure that the copper concentration of the PLS going to the tank house never exceeds the required limit.

8 Contact details:

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