GEOSCAN-M use at Ma’aden Phosphate Al Jalamid mine, Saudi Arabia

Luke Balzan
Scantech International, Australia, lbalzan@scantech.com.au

Zoran Bauk
Scantech International, Australia

Andrew Harris
Scantech International, Australia

Follow this and additional works at: http://dc.engconfintl.org/phosphates_viii

Part of the Engineering Commons

Recommended Citation
Luke Balzan, Zoran Bauk, and Andrew Harris, 'GEOSCAN-M use at Ma’aden Phosphate Al Jalamid mine, Saudi Arabia' in "Beneficiation of Phosphates VIII", Dr. Patrick Zhang, Florida Industrial and Phosphate Research Institute, USA Professor Jan Miller, University of Utah, USA Professor Laurindo Leal Filho, Vale Institute of Technology (ITV), Brazil Marius Porteus, Foskor-Mining Division, South Africa Professor Neil Snyders, Stellenbosch University, South Africa Mr. Ewan Wingate, WorleyParsons Services Pty Ltd., Australia Prof. Guven Akdogan, Stellenbosch University, South Africa Eds, ECI Symposium Series, (2018). http://dc.engconfintl.org/phosphates_viii/5
GEOSCAN-M Use at a Middle Eastern Phosphate Plant - Case Study -

Dr Luke Balzan, Ph.D, B.Eng (Hons)
3 May 2018
Scantech – Company Overview

• Founded in 1981 as Mineral Control Instrumentation (MCI)
• Core business is on-belt process control analysers for coal, cement and minerals industries
• ISO9001:2008 Certified
• Head office in Adelaide; Sales office in Brisbane; Service Engineers located in overseas hotspots
• Strong technical team performs its own R&D
• Over 1000 analysers sold worldwide (~90% exported)
• World leader in on-belt moisture and elemental analysis for minerals
Sensors for On-Belt Analysis

<table>
<thead>
<tr>
<th>MEASUREMENT TECHNIQUE</th>
<th>ANALYSIS PROVIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Gamma Ray Detection</td>
<td>%Ash in coal, %U in uranium ore, %Elements in ore</td>
</tr>
<tr>
<td>Dual Energy Gamma Ray Transmission</td>
<td>%Ash in coal</td>
</tr>
<tr>
<td>Prompt Gamma Neutron Activation Analysis (PGNAA)</td>
<td>%Elements in coal, cement raw materials, minerals</td>
</tr>
<tr>
<td>Microwave Transmission</td>
<td>%Moisture in coal, cement raw materials, minerals</td>
</tr>
<tr>
<td>Fast Neutron &amp; Gamma Transmission</td>
<td>%Moisture in electrically-conductive materials</td>
</tr>
</tbody>
</table>
GEOSCAN-M: The World’s First...

- GEOSCAN elemental analysers have been widely used for real time analysis in many commodities in the minerals sector for 15 years
- Extensive use in coal and cement industries
- Scantech supplied the world’s first on belt elemental analyser for iron ore in 2003, and now has over 40 GEOSCAN iron ore installations
- GEOSCAN has been adapted to other minerals, reporting a wide variety of elements present

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coal</td>
<td>2001</td>
</tr>
<tr>
<td>Iron ore</td>
<td>2003</td>
</tr>
<tr>
<td>Copper ore</td>
<td>2008</td>
</tr>
<tr>
<td>Iron sinter</td>
<td>2011</td>
</tr>
<tr>
<td>Manganese ore</td>
<td>2012</td>
</tr>
<tr>
<td>Lead-Zinc</td>
<td>2012</td>
</tr>
<tr>
<td>Phosphate</td>
<td>2014</td>
</tr>
<tr>
<td>Bauxite</td>
<td>2018</td>
</tr>
<tr>
<td>Lithium ore</td>
<td>2018</td>
</tr>
</tbody>
</table>
GEOSCAN-M in Phosphate

- The phosphate industry has adopted the use of GEOSCAN for analysis in a number of different applications over the past 4 years
- Initial phosphate testing carried out in 2013 at Scantech’s factory in Adelaide, Australia
- Testing verified the GEOSCAN’s ability to measure the elements of interest, namely phosphorus (as $P_2O_5$ and BPL), calcium and magnesium oxides, and sulphur, among others, at the concentrations typical in phosphate rock
- World’s first on belt analyser installed in the phosphate industry in 2014
Typical Applications in Phosphate

- Mine
- Geoscan 1
- Stockpile 1
- Stockpile 2
- Stockpile 3
- Stockpile 4
- Geoscan 2
- Processing Plant

Feedback to mine
Process control of additives, etc

3-May-2018 Slide 6 of 20 Commercial in Confidence
GEOSCAN-M Installations
How GEOSCAN-M Works

<table>
<thead>
<tr>
<th>( \text{P}_2\text{O}_5 % )</th>
<th>( \text{CaO}% )</th>
<th>( \text{S}% )</th>
<th>( \text{Al}_2\text{O}_3 % )</th>
<th>( \text{SiO}_2 % )</th>
<th>( \text{MgO} % )</th>
</tr>
</thead>
<tbody>
<tr>
<td>29.88</td>
<td>48.88</td>
<td>3.88</td>
<td>0.38</td>
<td>3.25</td>
<td>0.88</td>
</tr>
</tbody>
</table>
• GEOSCAN was installed after primary crushing and was commissioned in 2017
• Site performed installation; Scantech performed commissioning, calibration and radiation safety training
• Primary purpose is real time mine grade control using continuous 2-minute analyses
• Instantaneous, average and historical analysis data are available to plant
• Key elements of interest include $P_2O_5$, $CaO$, $MgO$, and $SiO_2$
• Moisture and several other elements are measured and reported
• Data provides feedback to mine for grade control, and is also used in downstream processing
Site Benefits from GEOSCAN-M

- Real time $\text{P}_2\text{O}_5$ mine grade data (previously waited 3 hours for laboratory data)
- Simple installation
- Online elemental analysis (various elements)
- Maintenance friendly
- No sample handling
- Non contact measurement
- Radiation safety
- Operational response times
- Mine resource management
Laboratory and GEOSCAN Comparison

• Installation of the GEOSCAN reduces site’s reliance on laboratory samples and allows immediate action for grade control
• Laboratory samples still collected for verification of GEOSCAN data
• Since commissioning, data validation processes undertaken by making comparison between laboratory data and GEOSCAN data
• Composite samples are collected over 1—2 hour period, and compared to GEOSCAN data collected over the same period
To determine the accuracy performance of the GEOSCAN, the root mean square deviation (RMSD) between laboratory and GEOSCAN analyses and is calculated as

$$RMSD = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (y_i - x_i)^2}$$

Calculation incorporates all sources of error, including sampling, handling and analysis errors, as well as GEOSCAN’s precision, yet performances are still excellent.

<table>
<thead>
<tr>
<th>Element/Oxide</th>
<th>$P_2O_5$ %</th>
<th>CaO %</th>
<th>SiO$_2$ %</th>
<th>MgO %</th>
<th>Al$_2$O$_3$ %</th>
<th>Fe %</th>
<th>Cl ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMSD</td>
<td>0.55</td>
<td>0.51</td>
<td>0.14</td>
<td>0.15</td>
<td>0.24</td>
<td>0.37</td>
<td>71</td>
</tr>
</tbody>
</table>
GEOSCAN Results

CaO %

MgO %

SCANTECH
Process control specialists

Commercial in Confidence
GEOSCAN Results

Cl ppm

- Geoscan
- Laboratory

3-May-2018
Slide 15 of 20
Through Belt Moisture (TBM) in Phosphate

- Most GEOSCAN-M include a TBM to measure moisture
- TBMs can also be installed independently
- TBMs utilise microwave transmission to observe two independent electrical properties of the material to measure moisture
- TBMs enable real-time analysis of moisture in the full bed depth of the conveyed phosphate
- TBM is widely used in minerals industries
TBM for Phosphate
TBM Performance on Phosphate Rock

Moisture %

Graph showing moisture percentage over time with two lines labeled TBM and Lab.
Conclusions

- GEOSCAN successfully applied for use in phosphates
- Wide uptake by numerous phosphate producers globally
- Middle Eastern case study presented, showing successful outcome for GEOSCAN measuring feed material
- Accuracy of equipment demonstrated compared to laboratory analyses
- Site already observing significant benefits in grade control and downstream processing
- Increasing use of GEOSCANs on site for process control and improving result visibility with Historian
Thank you!

Any Questions?

www.scantech.com.au