5-3-2018

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

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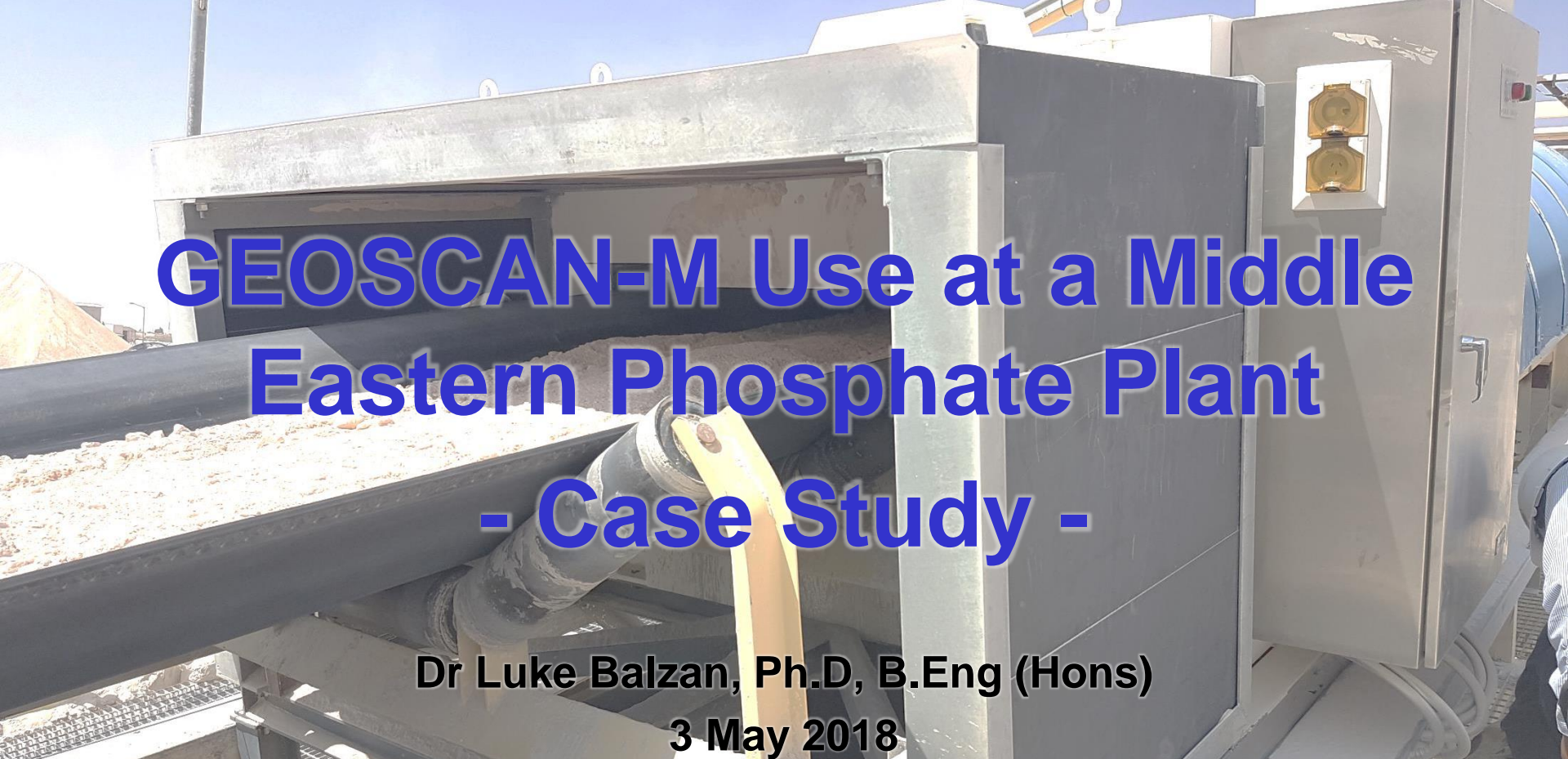*Scantech International, Auatralia*

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GEOSCAN-M Use at a Middle Eastern Phosphate Plant - Case Study -

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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

MEASUREMENT TECHNIQUE	ANALYSIS PROVIDED
Natural Gamma Ray Detection	**%Ash** in coal, **%U** in uranium ore, **%Elements** in ore
Dual Energy Gamma Ray Transmission	**%Ash** in coal
Prompt Gamma Neutron Activation Analysis (PGNAA)	**%Elements** in coal, cement raw materials, minerals
Microwave Transmission	**%Moisture** in coal, cement raw materials, minerals
Fast Neutron & Gamma Transmission	**%Moisture** in electrically-conductive materials

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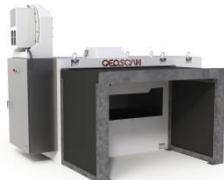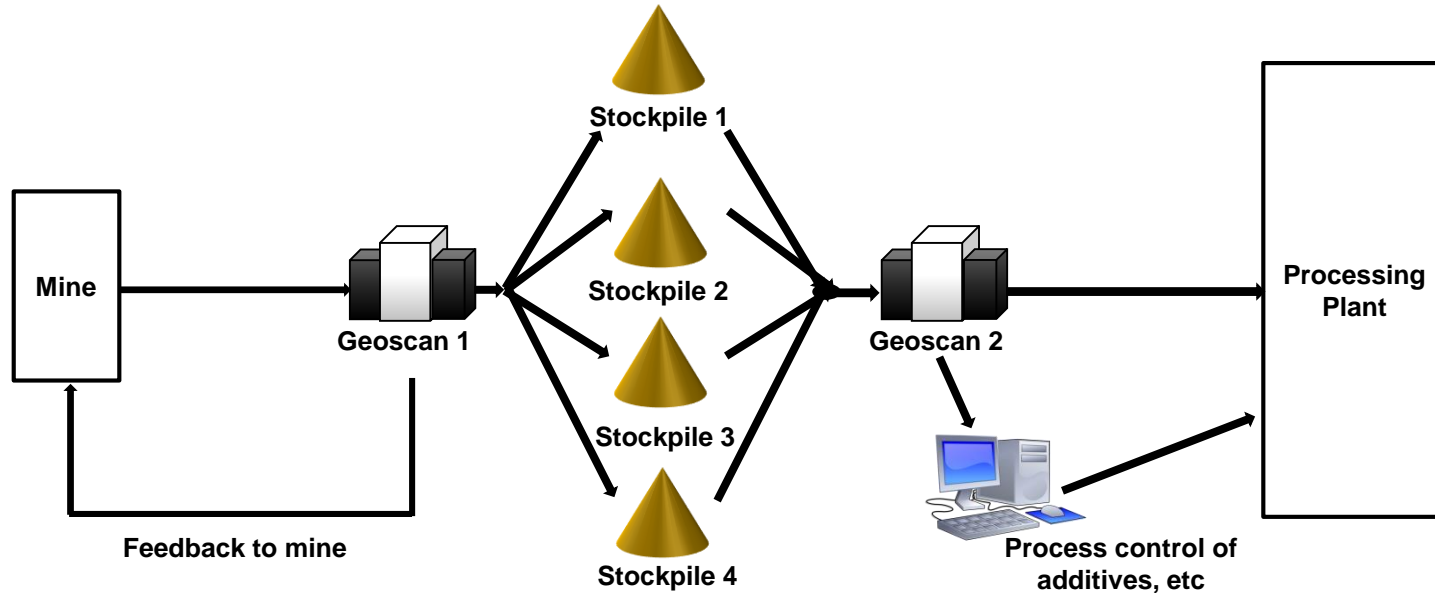
GEOSCAN-M: The World's First...

- 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

Commodity	Year
Coal	2001
Iron ore	2003
Copper ore	2008
Iron sinter	2011
Manganese ore	2012
Lead-Zinc	2012
Phosphate	2014
Bauxite	2018
Lithium ore	2018

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

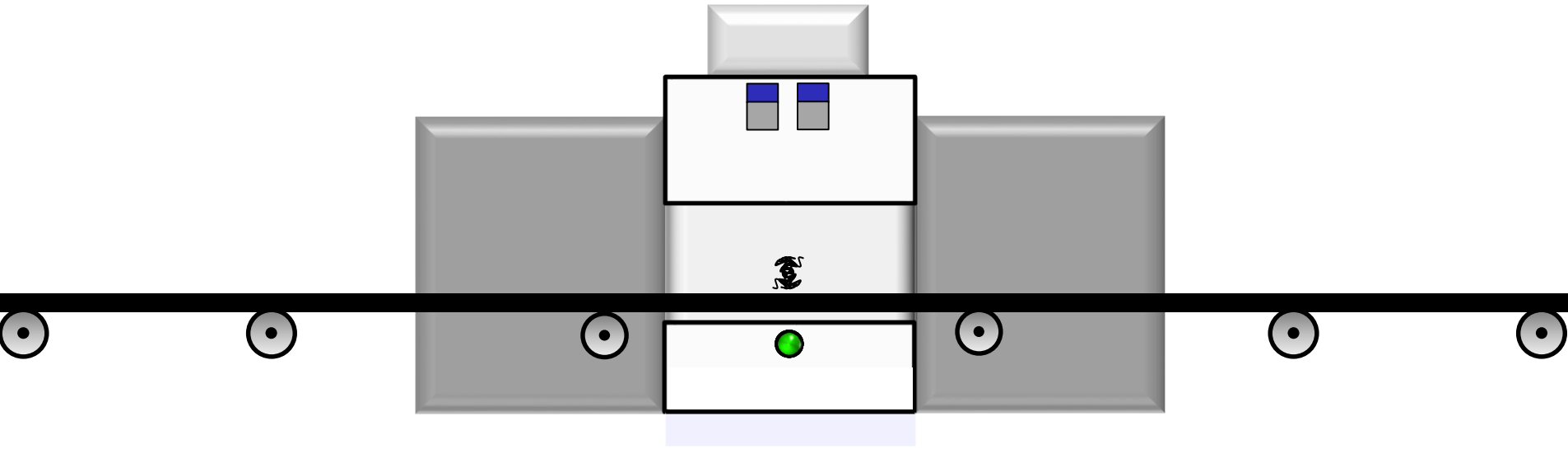- World's first on belt analyser installed in the phosphate industry in 2014

Typical Applications in Phosphate

GEOSCAN-M Installations

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How GEOSCAN-M Works

P$_2$O$_5$ %	CaO%	S %	Al$_2$O$_3$ %	SiO$_2$ %	MgO %
29.50	48.93	3.50	0.35	2.25	0.95

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GEOSCAN-M in Middle Eastern Phosphate

- 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

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Site Benefits from GEOSCAN-M

- Real time P_2O_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

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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

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Laboratory and GEOSCAN Comparison

- To determine the accuracy performance of the GEOSCAN, the root mean square deviation (RMSD) between laboratory and GEOSCAN analyses and is calculated as

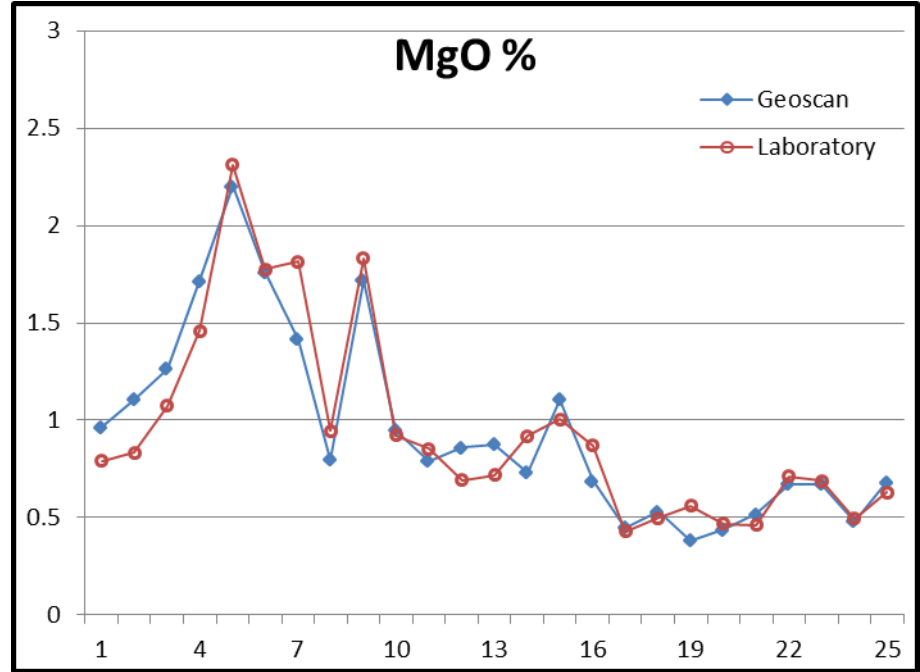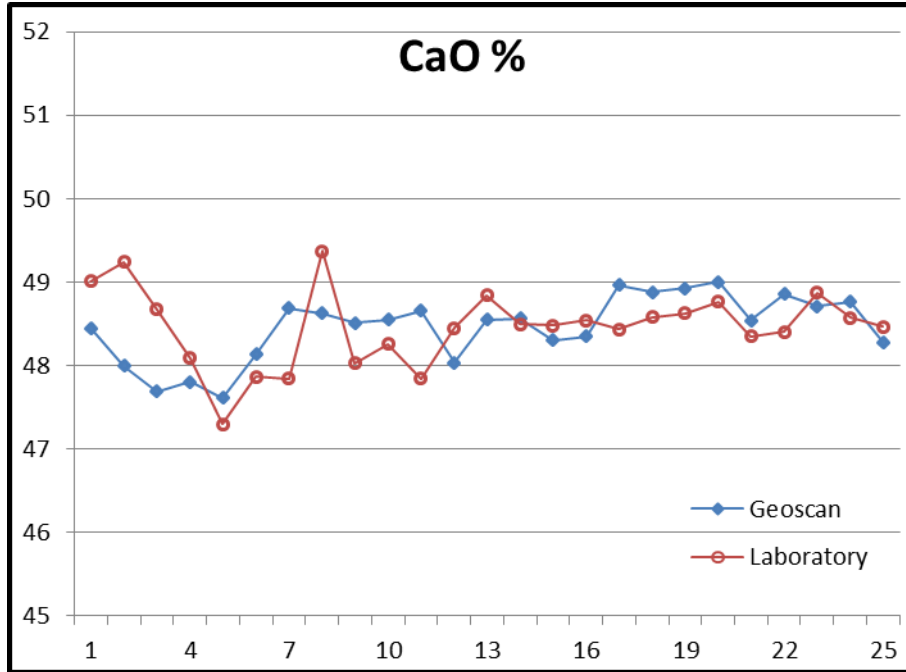$$RMSD = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - x_i)^2}$$

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

Element/Oxide	P_2O_5 %	CaO %	SiO_2 %	MgO %	Al_2O_3 %	Fe %	Cl ppm
RMSD	0.55	0.51	0.14	0.15	0.24	0.37	71

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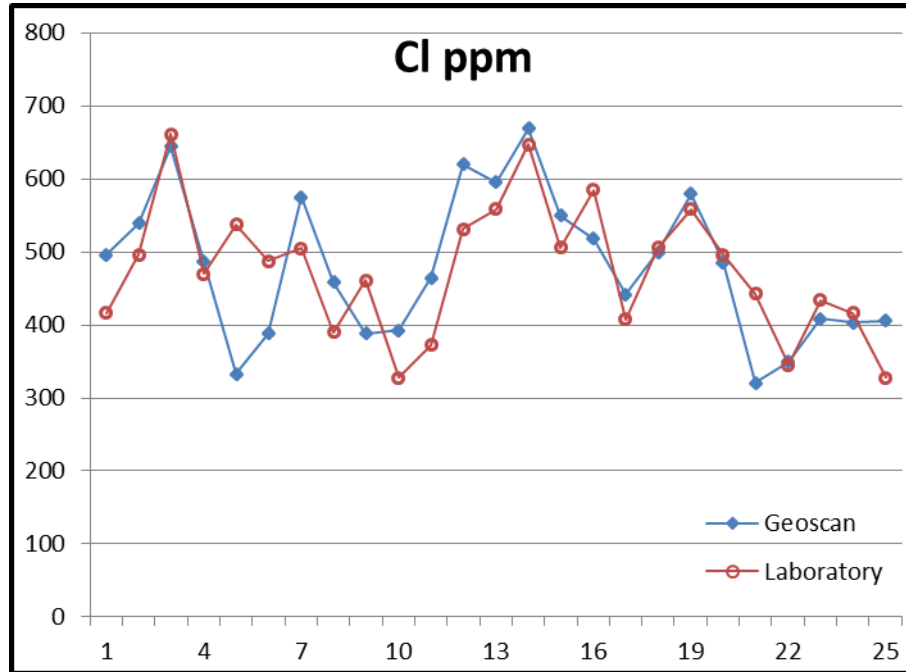*Process control specialists*
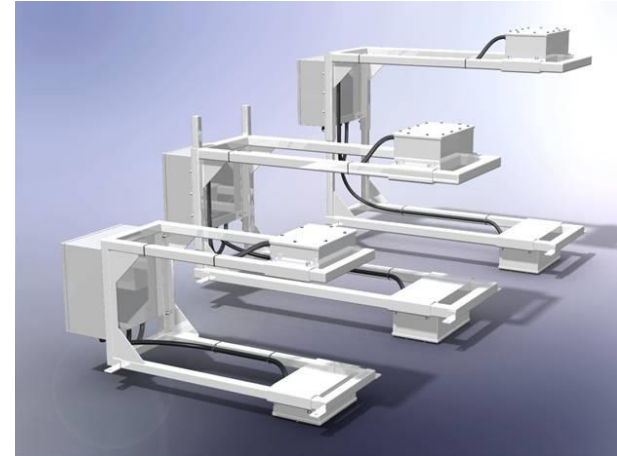
GEOSCAN
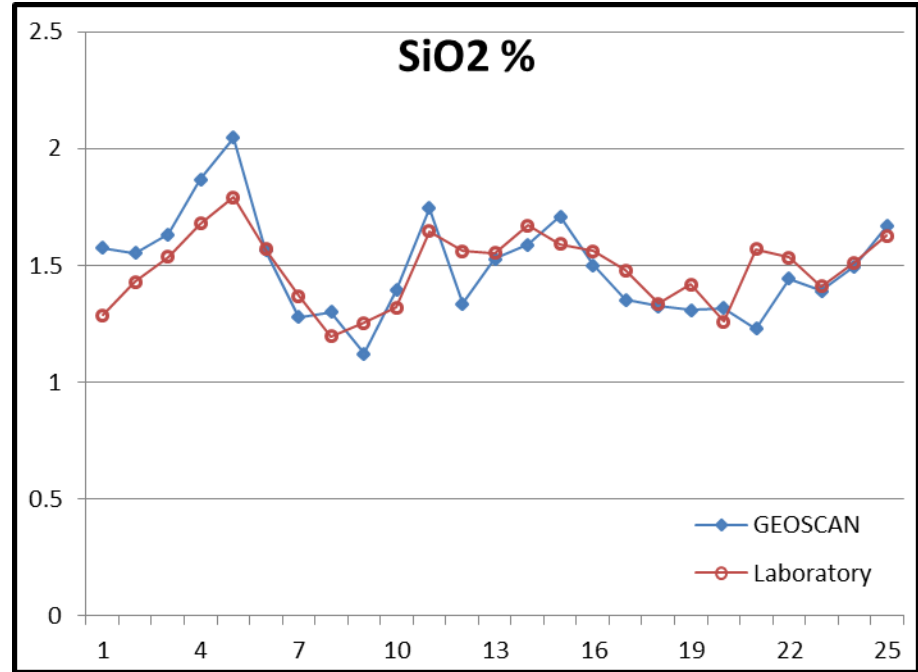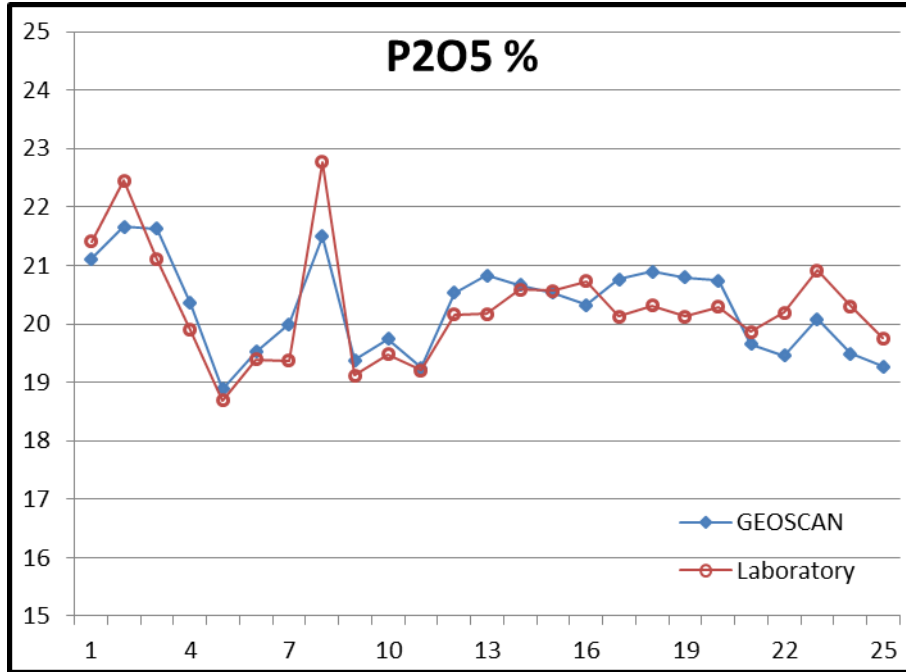
GEOSCAN Results

GEOSCAN Results

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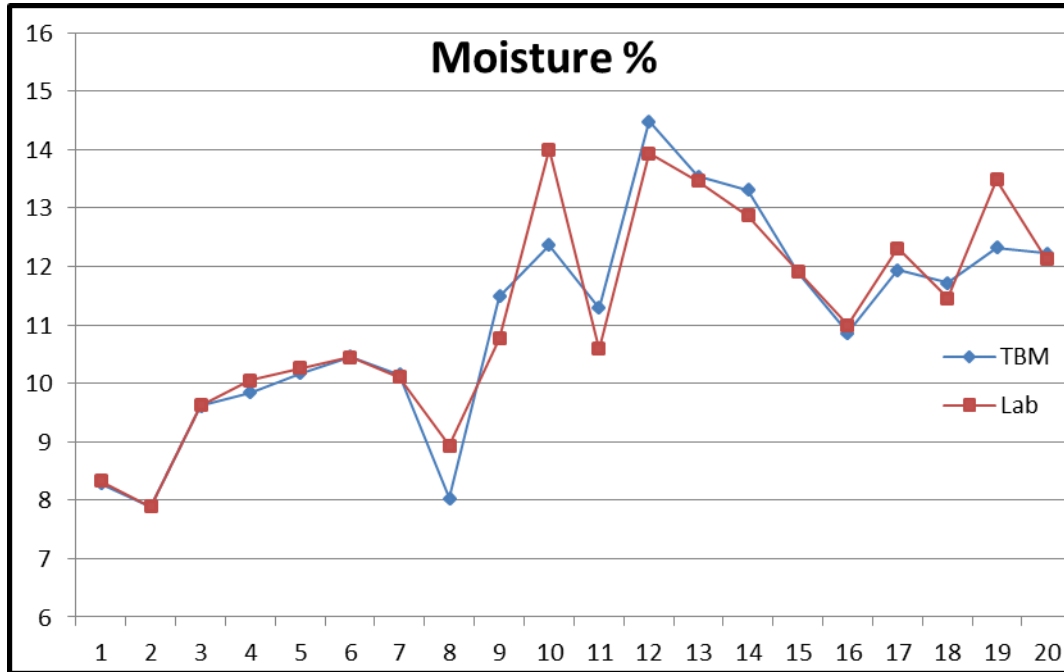
Through Belt Moisture (TBM) in Phosphate

- 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

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TBM for Phosphate

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TBM Performance on Phosphate Rock

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

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Thank you!

Any Questions?

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