

## A TRUSTING RELATIONSHIP



Dear Reader,

2015 has turned into a very challenging year for both mining and steel industries. Worldwide economies have been hit by volatility of capital markets, devaluation of local currencies and regional instabilities. Growing concerns about economic development and overcapacity in both iron ore and steelmaking resulted in falling product prices.

Samarco's philosophy has always been to establish and maintain long-term relationships with its customers since its foundation 38 years ago in August 1977. This allows us to better understand our customers, adding value in more ways than just supplying top grade pellets. We believe that developing together in partnership is key to overcoming challenges in light of the complexity of the mining and steel sectors.

We have conducted several R&D projects with customers and collaborators across the years, which illustrate our efforts to improve the products and services we offer. This issue of Samarco Update brings to you an article called "Focus on Innovation", where we describe two of these studies that are valuable for both customers and Samarco.

Samarco considers continuous improvement as a core competence and stimulates all employees to propose innovations that improve processes, products and services. In the article "The Path to Excellence" we show how we encourage our people to bring new ideas and how the implementation of the best ideas delivers important results.

Samarco has been elected the best mining company in Brazil by three different rankings. This could not have been realized without working closely with our customers. We are very proud that we have customers with contracts for over 20 or even 30 years. Companies that grew and developed together with Samarco in good and more challenging times. We keep on looking for further improvements that deliver value for all our stakeholders in order to overcome the current headwinds.

I invite you all to join in this search!



**Roberto Carvalho**  
Commercial Director

## FOCUS ON INOVATION

*A study to predict degradation during handling was presented in the latest edition of METEC-ESTAD - The paper is available to download in this edition.*



The latest edition of METEC-ESTAD - European Steel and Technology Application Days 2015 was held in June in Dusseldorf, Germany. The event was attended by roughly 1,300 people of 45 nationalities. Samarco presented five projects that will be available to our readers along the next issues of Samarco Update. In this edition we will discuss the paper titled “Predicting Iron Ore Pellet Degradation due to Handling from Pellet Plant to Steel Mill”.

Degradation is a physical phenomenon that occurs due to the severity in the unloading and handling stages, resulting in decreased mass yield and operational losses for both steel plant and pellet supplier.

Several variables can influence the degradation. Some of them depend on the intrinsic characteristics of the iron ores and others depend on the severity of the handling steps. Moreover, the degradation of the pellets increases proportionally to the mechanical stresses to which the particles are subjected. These stresses may vary from

drops in transfer chutes between conveyor belts, vessel loading systems to the lightering or transshipment operations prior to discharge at ports with limited depth.

In spite of their greater strength when compared to lump iron ores, pellets also undergo some degradation, that can reach different levels according to the severity of the circuit from the pelletizing plant to the end user. While efforts are continuously made at pelletizing plants to reduce this effect, both by improving pellet quality and minimizing the collisions during the transport, it was found that characterization methods that were routinely used according to the International Standards were not capable of providing appropriate data for predicting pellet degradation.

Along the last five years, in partnership with LTM/COPPETEC Research Institute of Federal University of Rio de Janeiro, our specialists developed a device that makes destructive tests simulating shipping and handling conditions to which the pellets are subjected and a mathematical model that

describes pellets behavior according to pre established physical properties.

The model discriminates the contributions in the degradation phenomena of both pellets characteristics and details of handling circuits. The latter includes steps such as shipment and transshipment operations, transfers between conveyor belts in chutes and drops in stacking operations at stock yards, adding along the route the different possible contributions to the handling process to the result of the pellets degradation.

The equipment also enables the measuring of the physical characteristics of the pellets,

such as impact resistance and energy required for fracture. This is an important tool for decision making and improvements to reduce degradation, through modifications in the handling system or through the development of new products.

To validate the predictions a comparison between data actually measured and

simulation was performed in a case study developed with a customer whose handling system initially showed considerable severity. After the simulation and identification of critical steps, mitigation solutions were proposed, as well as training of the professionals involved, with a potential 5% reduction.

Our customers can access the whole paper through the link below.

[Predicting Iron Ore Pellet Degradation due to Handling from Pellet Plant to Steel Mill](#)

The other projects presented by Samarco in this edition of METEC-ESTAD 2015 are “The Effect of High Grade Sinter Feed in the Sintering Process”, “Redcarb Software for DRI Carburization in Shaft Furnaces Modeling”, “Softening and Melting Characteristics of Pellet - Sinter Mixtures” and “Pelletizing Pilot Scale Simulation through Mathematical Modelling: A Goethite-Martite Iron Ore Study”.

The papers were developed in partnership with renowned

research centers and universities, and whenever possible, validated with operational data from the processes of our customers.

“Samarco’s strong participation at METEC-ESTAD 2015 is not just translated by the significant number of projects presented, but mainly by the technological impact brought to the event, through studies that demonstrate our constant pursuit of excellence in developing products and solutions that create value for our customers and increase the efficiency of our processes,” says Dr. Mauricio Marcos Otaviano, Product Specialist at Samarco.

## THE PATH TO EXCELLENCE

*Ideas proposed by employees can generate savings of US\$ 8.93 for every US\$1.00 invested*

Investing in innovation and in the development of good ideas can be a rewarding strategy to pursue excellence and continuous improvement of industrial processes. In Samarco, The “Field of Ideas” Program was one of the first initiatives in this regard. The program has existed since 1999, and was created based on a project developed by company executives in partnership with a renowned Brazilian educational institution.

Since then, the company has been encouraging several kinds of initiatives that are implemented with support of quality management tools such as Kaizen, Six Sigma and Lean Office.

The innovation programs make employees feel appreciated, stimulate the training and development, and foster team spirit. Many of the projects are developed by multidisciplinary



Awarded team in 2015’s Annual Recognition event

groups, whereby employees from different areas come together in search of a solution.

In our case, the benefits are reflected in gains such as increase in productivity, improvements in product quality, costs reduction, optimization in use of natural resources, environmental preservation, and prevention of risks associated with health and safety.

In 2014 the return for every US\$1.00 invested in the program was US\$ 8.93 through the implementation of the proposed projects.

#### Methods to innovate

Currently Samarco uses four methodologies to guide the implementation of innovative ideas: Lean Six Sigma, Kaizen, Field of Ideas and Lean Office. Each program is used according to the degree of complexity of the solution in development.

Lean Six Sigma is a methodology based on reduction of waste and variability by focusing on reducing costs and increasing operational efficiency. It is suitable for the development of more complex solutions, based on the analysis of statistical data.

Kaizen is applied for quick improvements through the articulation of common sense and creativity. The method is used to solve problems of lower complexity, with known causes.

The “Field of Ideas”, created 17 years ago, currently is opened to participation of Samarco’s contractors besides our own employees. Based on a pre-established concept everyone is encouraged to contribute and think of innovative solutions. Since the program’s creation, 27,460 ideas have been generated and 12,282 projects have been implemented.

One of these ideas resulted in the conception of a new device to speed the replacement of belt conveyors’ bearings. Maintenance time was reduced from 12 hours to 3 hours and risks of accidents were also improved. This project, implemented in 2014, resulted in annual savings of US\$ 468 thousands.

In turn, Lean Office proposes improvements to administrative environments, acting directly on reducing waste and optimizing activities.

#### Spaces for new ideas

To establish this concept it is very important to create an

atmosphere that stimulates innovation. Instructing leaders to encourage their teams and awarding the best accomplishments can be a fruitful exit. Since 2008 Samarco established an Annual Recognition Event as a way to value the participation of its employees. This year we selected 40 studies conducted by multidisciplinary teams from the industrial units of mining, processing and pelletizing.

The initiatives were presented to judging committees composed of professionals from major companies in the mining, steel, polymers and services sectors. The commissions chose the top three entries under each methodology, using the results obtained by each team as the main criteria.

One of the winners was a project that improved automation and increased the utilization of the reclaimer of Pellet Plant #4. The study was implemented with support of Kaizen methodology and generated gains of 27% in the average time of reclaiming with an avoided Capex cost of US\$ 1.7 million.

The authors of the winning projects were awarded by Samarco’s top management as a demonstration of the importance of the program to the entire organization.

## HOMEMADE TECHNOLOGY

*A project to reduce costs and improve safety at chemical laboratories*



*This year, 13 projects received ABM's recognition for technical contributions*

The project “Assessment of the influence of cracks on the magnetic permeability index of pellets for defining a new method to measure FeO”, developed by Samarco employees from the pelletizing plant laboratory, was recognized by the Brazilian Association of Metallurgy, Materials and Mining (ABM) as the winner of the Technical Recognition Award, presented to the most outstanding technical contributions to the 2014 Seminar.

The study consists of creating a new method for measuring levels of iron oxide (FeO) in iron ore pellets allowing reduction in time for analysis, improvement in productivity and environmental gains, with an 85% decrease in emissions of chromium waste.

## WORK RECOGNIZED

*Three local publications awarded the best Iron & Steel companies in Brazil*



Samarco was awarded by three different business magazines in the month that it celebrated its 38th anniversary. This recognition makes us believe that we are on the right track regarding our philosophy, the values we trust, management excellence and the product quality that we strive to keep.

This year's *Valor 1000* yearbook rewarded Samarco as the best company in the Brazilian Mining & Steel category. The *Valor 1000* listing is an annual publication of a renowned business newspaper that presents an indepth analysis of the most important companies in the country. There are special reports on those that were most outstanding in 25 sectors of the nation's economy. The score is determined according to evaluation of financial institutions such as largest banks and insurance companies and analysis of several macro-economic criteria.

Samarco was elected, for the third year in a row, as the best mining company in Brazil by *Época Negócios* magazine in early August,. The publication recognised the best companies in 2014 based on criteria such as financial results, future vision, capacity to innovate and corporate governance.

Earlier this year, the company received the award for Best Mining Company in Brazil, also the third consecutive year, in the “Best and Biggest” ranking elaborated by *Exame* magazine. In the same publication, Samarco was also named as

Brazil’s second largest mining company and 61st largest company overall, among the 500 largest domestic companies.

## RECORDS AND ANNIVERSARIES

In this edition, Samarco pays special tribute to customers completing 20, 10 and 5 million metric tons shipped over the course of several years of relationship:

**Nu-Iron:** Customer since 2007. In May the company surpassed the milestone of 5 million metric tons.

**Qatar Steel:** Customer since 1990. In May we achieved the milestone of 5 million metric tons shipped.

**Bao Steel:** On September 28, Samarco CEO Ricardo Vescovi and CCO Roberto Carvalho and Mr. Dai Zhihao, Mr. Zhang Dian Bo, and Mr. Yuan Tao, Bao Steel’s purchasing executives, celebrated the milestone of 20 million metric tons shipped. Bao Steel has been a Samarco customer since 1998.

