Application of Aluminium Metal Business System (AMBS) Principles and Tools to Increase Productivity of Anode Covering Material Plants

André Ferraioli[1], Marcus Basiliense[2], Isaias Souza[3], Emerson Santos[4], Jeff Lima[5] and Marionildo Silva[6]
1. Process Engineer
2. Maintenance Manager
3. In Charge Of Outsourced
4. Maintenance Engineer
5. Process Technician
6. Operational Manager
Albras Alumínio Brasileiro S.A., Barcarena, Brazil
Corresponding author: ferraioliandre@hotmail.com

Abstract

With the removal of aluminum spray from the anodes, demand for cover material increased from 370 tonnes to 500 tonnes / day. To support the achievement of this result, actions based on the principles of AMBS were carried out:

- Principle 1- Systematically analyze the process and propose improvements in operation and maintenance. Result achieved: increased operational availability from 83 % to 92%, applying the SPC (Statistical Process Control) methodology;
- Principle 2- Improve satisfaction and customer service level (Reductions). Result achieved: reduction of the variance of the percentage of alumina in the anode cover material (ACM), according to the standard established by the client;
- Principle 3- Improve the feed flow of crusher crushing systems. Result achieved: study and implementation of operating logic to increase plant productivity (ton / h);
- Principle 4 - Implement the sense of ownership among crushing operators, through productivity / operator / shift measurement. Result achieved: increase in overall team productivity;
- Principle 5 - Recognize the good practices of teams with leadership follow-up. Result achieved: increased team engagement.

Keywords: Self-optimization, flowmeter, anode covering material.

1. Introduction

For a company remain strong and competitive in its line of business, a policy of continuous improvement and cost efficiency is essential. In this scenario, the removal of aluminum spray had a prominent role. This action directly impacts the production of ACM, since it will be the material that will replace the role of the spray in the main function of isolating the anode, reducing the effects of the oxidation in the pots. The ACM also has other important functions, such as to perform the thermal balance of the pots and to control the level of bath among others [1].

Due to these vital and irreplaceable functions of the ACM, the production plants of this material had the challenge of increasing the quantity of material supplied to the pot in 33% without any increase in equipment capacity, and for this improvement in efficiency, the principles and foundations of the AMBS methodology were used as a basis.

During the next topics we will detail how each principle of the AMBS contributed to the increase of production.

2. Standardized Work

One of the success factors was the standardization of the operational performance analysis, starting with an evaluation and exchange of quick and objective information in the shift exchanges between the operators and driven in KPI's presents in Table 1.

Table 1. Table shifts exchanges.

CRITICAL PROCESS GROUP - Crust — ALBRAS

	INDICATOR	UN	GOAL	SUN	MON	TUES	WED	THU	FRID	SAT
Silo Level	Alumina	t								
	Crust	t								
	Bath	t								
	ACM	t								
Transported Material	ACM Send to the Pot's	t								
	Alumina Entry	t								
Crust	Butts	Peças								
	Crushed material	#								
Recipe	Alumina on ACM	%								
Granulometry	> 3,5 mm	%								
	< 200 #	%								
Unscheduled Stops	Interfering Time	Min.								
	Equipment / Reason	#								

The other action taken was the definition of a new methodology of analysis of the breaks for decision making, based on statistical process control (SPC), where the equipment breakdown numbers are analyzed on a weekly basis in sequence graph (see Figure 1), from Figure 2. These graphs are created with the objective of stratifying these data so that these parameters are the factors that will guide decision making.

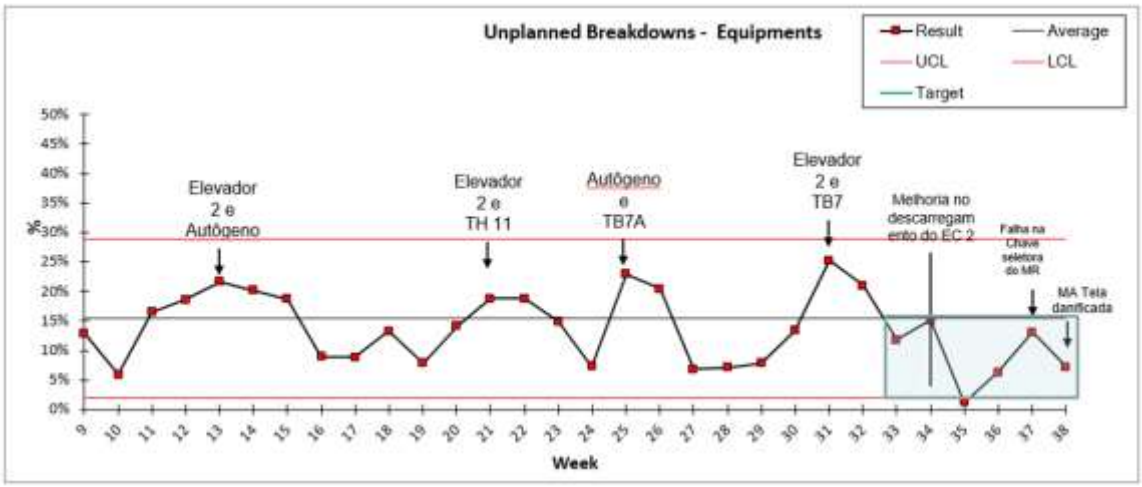

Figure 1. SPC of equipament failure.

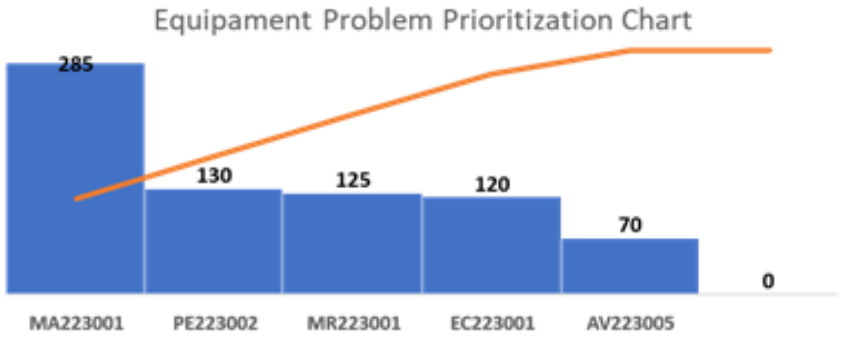

Figure 2. Equipment problem prioritization chart.

Thus, the availability of equipment increased by 10 percent, from 83 to 92%. This result is one of the pillars that enable us to sustainably increase the amount of material processed and delivered to the customer.

3. Dedicated Teams

Another important point in improving the performance of the productive area is related to the motivation and individual performance of each employee. For this indicator to emerge from the abstract or "feeling" of people, individual indicators of productivity were created.

In order to be able to measure the production of each one, a general mapping of all the stages of the productive activities was carried out, where an engineer studied the productive capacities of the industrial equipment and capacity of transport of the buckets of the loaders, and on the spot determined how these were being used. After several measurement tests, the result was the elaboration of a worksheet where it was possible to separate what was being produced by equipment and the human being in a systematic way per shift.

From this information, the managers analyze the performance graphs of each operator (Figure 3), where monthly feedback is given to them and for the renewal of the frame this is a very strong indicator along with the safe behavior among others.

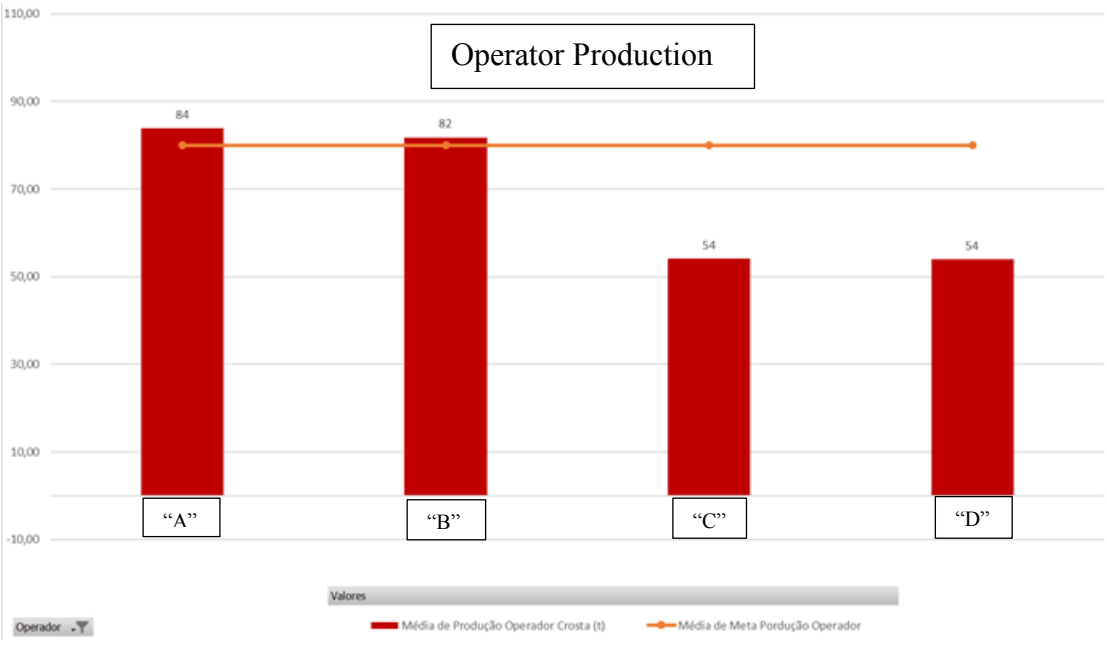

Figure 3. Each operator productivity.

4. Optimized Flow

One of the gains of the survey of the whole productive sector was the creation of an online production meter of the plants (Figure 4), thus, we created the possibility of monitoring the performance of any place of the world in real time and of being able to analyze the frequency of stops or any disturbance that affected the process.

Figure 4. Production chart before the critical group actions.

By performing a reflection it is possible to observe that the plant had many stops during the shifts of operation. Aiming at solving these problems the time of all the activities involved in the production such as for example time the loader going in the bay and bringing crust to the feeder, cleaning time of an anode cleaned by the Glama, have been improved. However, the greatest gain was in the feeding time of the vibratory feeder, which it was increased by 25 %, after maintenance in the autogenous mill, thus guaranteeing a greater productivity limiting the time of stops only in the shift exchanges where the autogenous mill cleaning is done, removing remains of butts and aluminum that end up entering during the operation of the plants.

Following these improvements, the result can be seen in Figure 5.

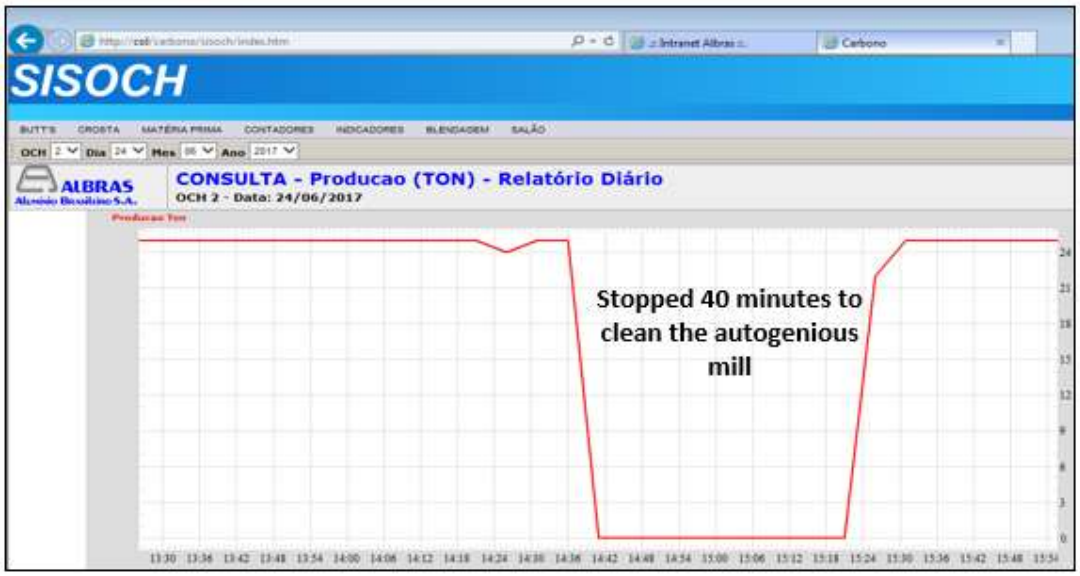

Figure 5. Production chart after the critical group actions

5. Relationship Between Client and Providers

The deliverables for production are clear and objectives and are defined in agreement between client and providers signed by the two areas involved, with respect to these indicators because the plant is producing with fewer stops thus reducing the time it takes for the equipment to stabilize the ACM, since it works flat now, this brought us a gain in quality, reducing the variation of the addition of alumina.

We deliver now a more uniform material with a superior quality shown in Figure 6.

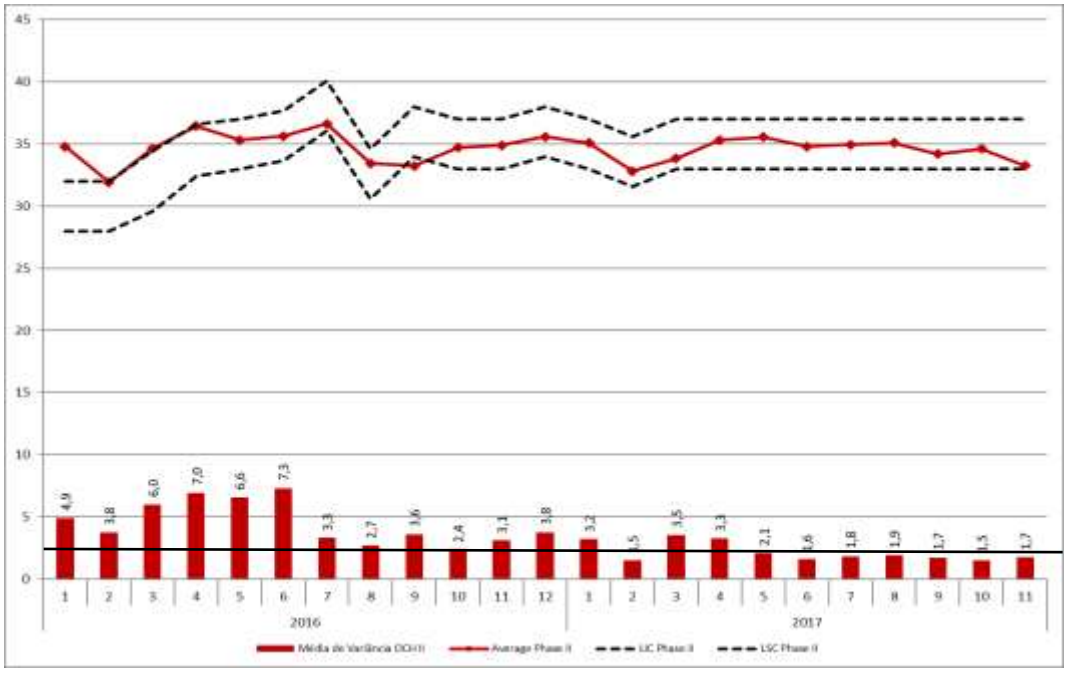

Figure 6. Variance of alumina recipe.

6. Visible Leadership

To ensure the continuity of all actions taken and anticipate deviations we rely on the managers and staff presence every day in the productive areas, auditing the activities that are being carried out. All records of the audits carried out are imputed in a system with audit goals for each one where they are generated accompaniment charts that approach in the determination of the priorities that must be worked out.

7. Conclusions

The removal of spray of the aluminium from anodes is generating an economic yearly gain of approximately one million dollars, considering the amount of alumina that oxidized and had not returned to the pot, spending of electricity and gas in the ovens, maintenance of the application station spray and labour costs.

Always prioritizing sustainability of the results, the principles and tools of AMBS we give total support proportional to the size of the result achieved: a 33 % increase in processed material with production record of 511 tons per day in November 2017.

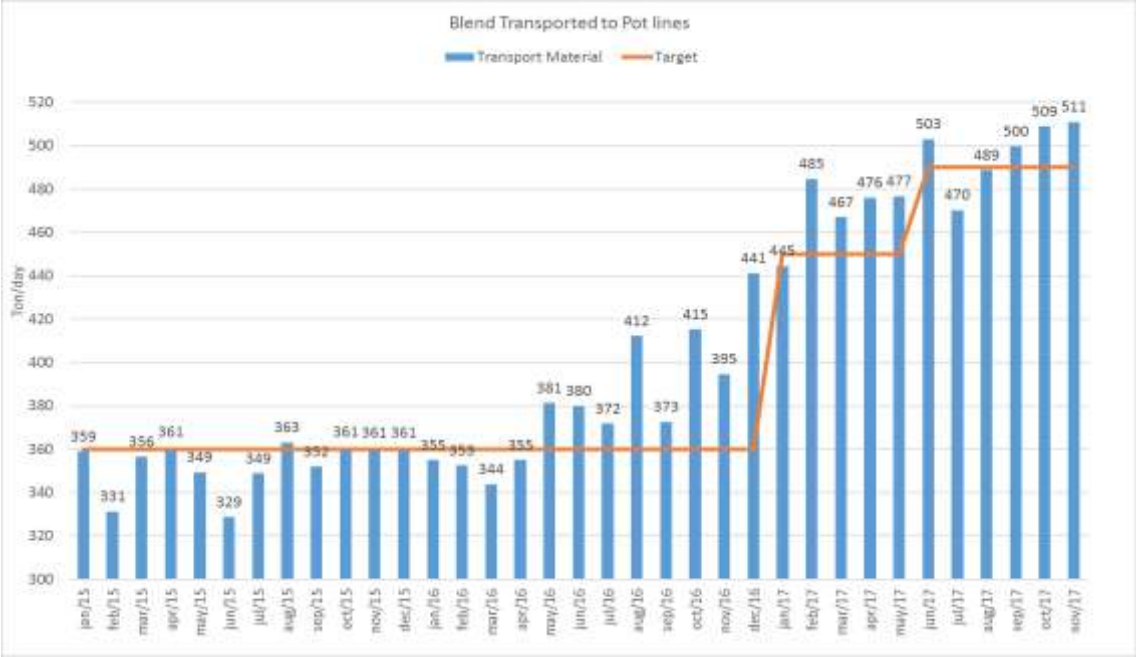

Figure 7. Production evolution.

8. Reference

1. Siegfried Wilkening, Pierre Reny and Brian Murphy, Anode cover material and bath level control, *Light Metal*s, 2005, 367 – 372.