



# **Improving the Quality at Alunorte Using PI System**

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# Our Mission

**“Supply alumina of superior quality, guaranteeing low operational costs with the best productivity, safety and protection to the environment”.**



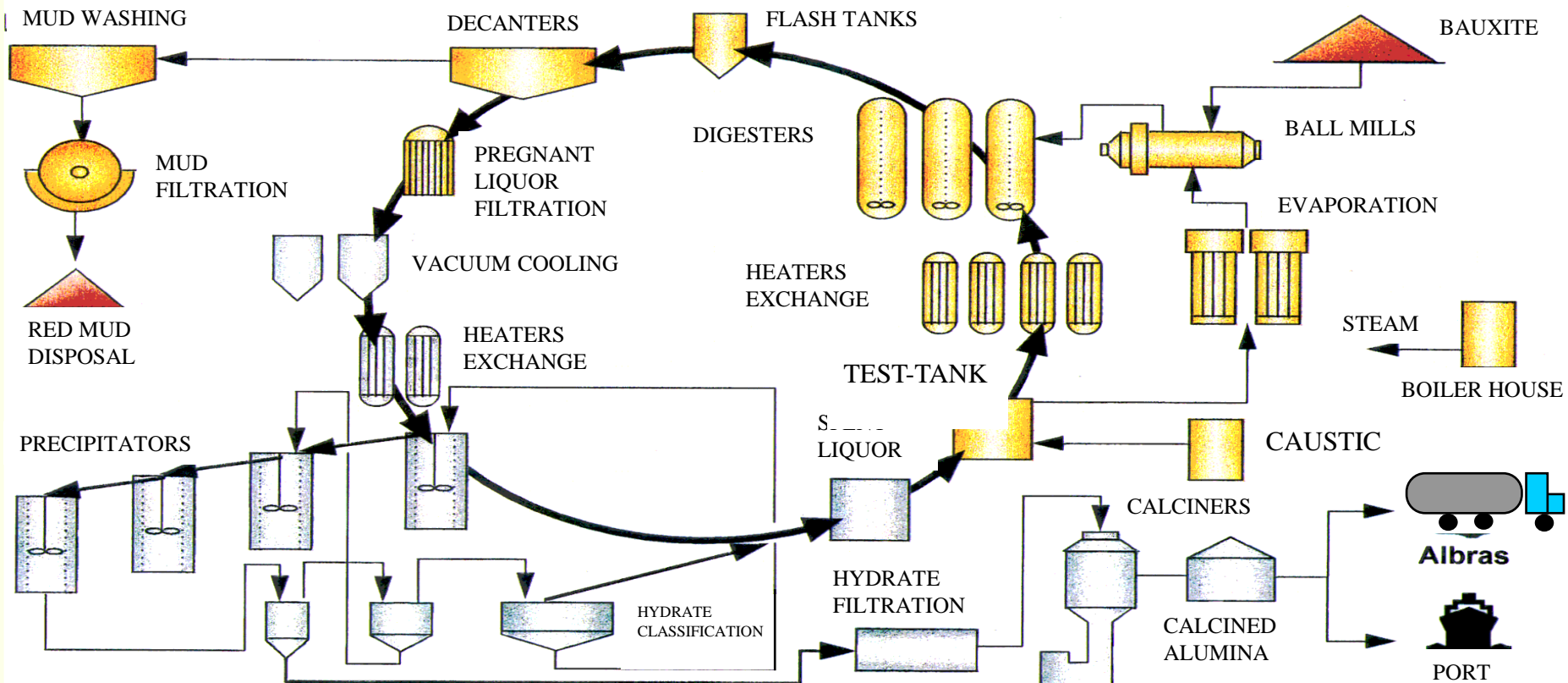
# General Information

## Information

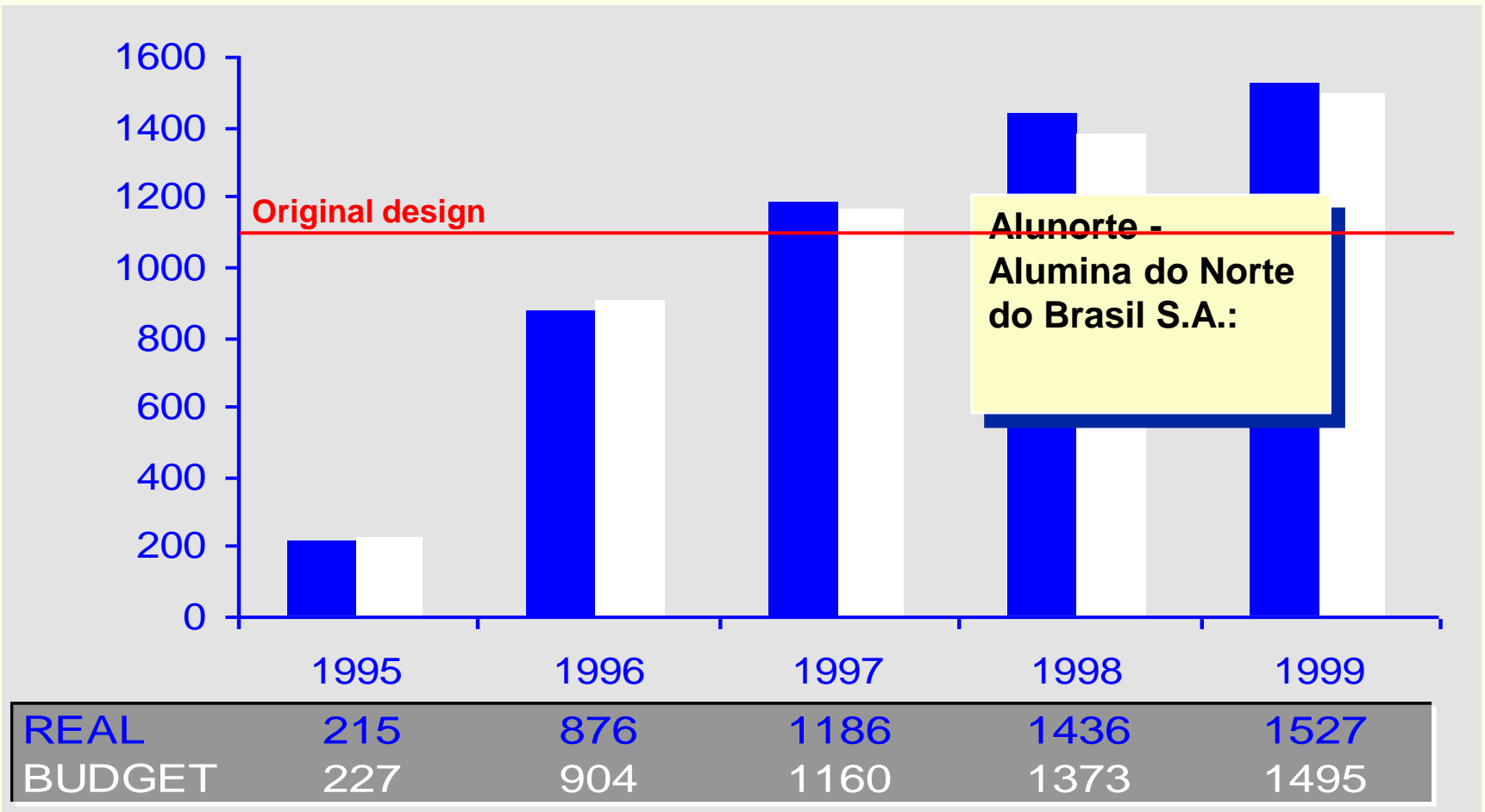
- A company with global investment of U\$ 875 millions.
- Start-up in 95, reaching nominal capacity in 97.
- 460 employees.
- 383 contracted workers.

# Process Flowsheet

## BAYER PROCESS FLOWSHEET



# Production data (000 ton)

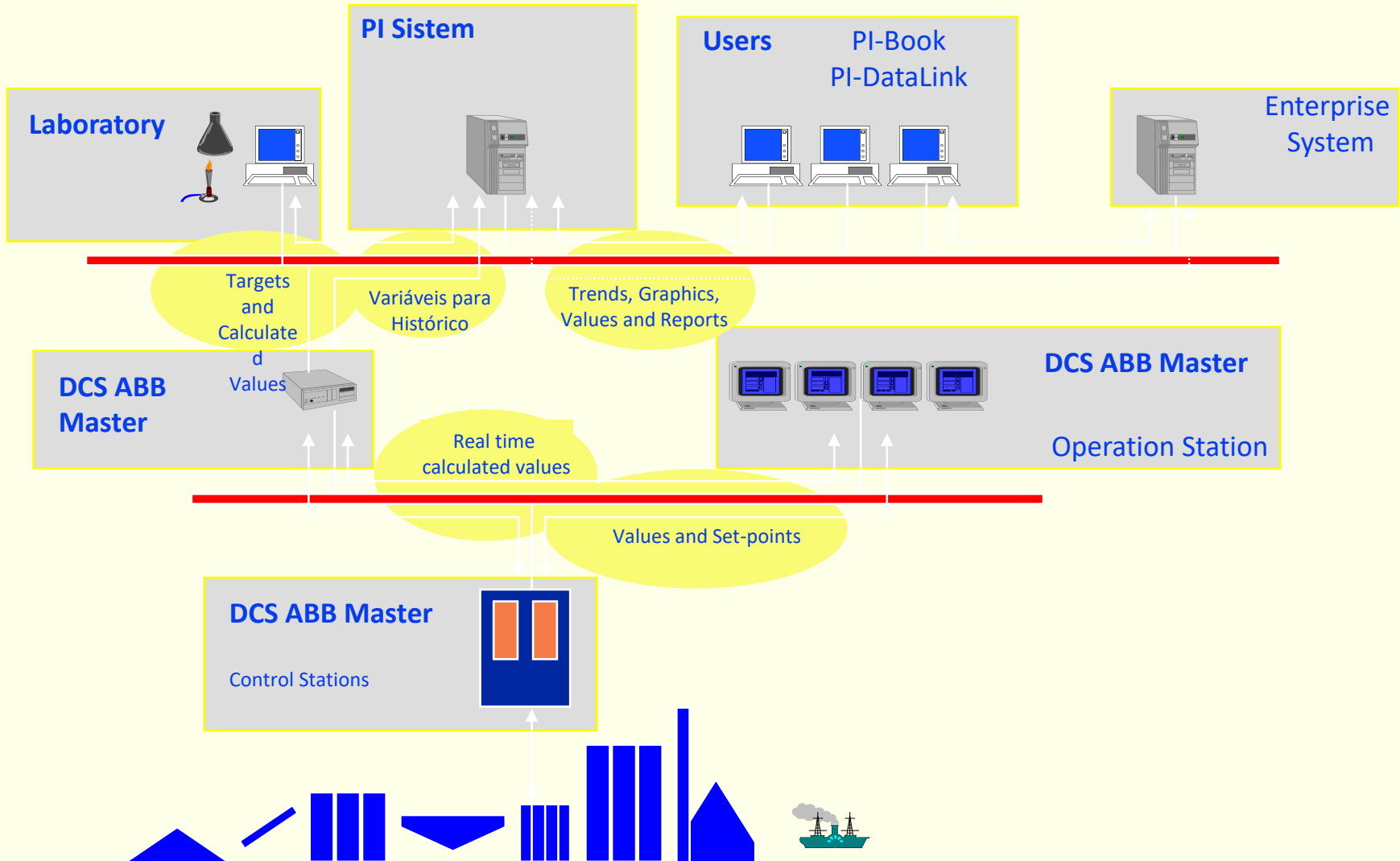


# Alumina Quality Evolution



ANALYSIS		SPECIFICATION (%)		YEAR AVERAGE				
		TIPICAL	MAX	1995	1996	1997	1998	1999
CHEMICAL	Na <sub>2</sub> O	0,400	0,500	0,36	0,41	0,45	0,37	0,37
	SiO <sub>2</sub>	0,015	0,025	0,022	0,016	0,015	0,016	0,015
	Fe <sub>2</sub> O <sub>3</sub>	0,015	0,025	0,016	0,010	0,008	0,007	0,006
PHYSICAL	LOI ( 300 - 1100°C )	0,80	1,00	-	0,76	0,70	0,73	0,73
	- 325 MESH	8,0	10,0	11,4	7,1	3,0	4,0	4,8
	B. E. T. (m <sup>2</sup> /g)	70	80	78	73	77	77	76

# Alunorte's Network





# PI Hardware



- DIGITAL Personal Workstation (500 mhz), running Windows NT 4.0 Server
- 256 Mb RAM Memory
- 3 x 4gb HD
- Raid 5 Controller
- HP-9000, running HP-UX, 10 as interface between PI and DCS







# Some Systems Developed Using VBA

- Alumina Storage Monitoring
- Alumina Quality Monitoring
- Continuous Ship Unloader Occurrence
- Items Control
- Plant Occurrences

# What Means PI Culture ?



- PI-Book is the only data link among plant floor and managers, including Director;
- Intensive PI-Datalink use to find out the answers to Process and Maintenance problems
- PI-Book consolidation as the unique tool to access all Windows based System
- Intensive use of calculated tags in order to automate data generation





# Alumina Quality Monitoring System

- Allows continuous alumina quality monitoring, in real time, in order to detect process deviations and pro-active actuation by process people
- Was used as support system to ISO 9.0002 Certification
- Totally developed by Alunorte's people
- Has been used by operational and process people as a routinely tool to track quality deviations
- Was developed using a Drilling-down technique, in order to permit the scanning since the quality variables up to process variables in a sorted way and increasing the changes to find out the main reason to quality deviation in shorter time

# Alumina Quality Monitoring System Main Screen



Microsoft Excel - Stmqal32.xls

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Arial 10

**Alunorte** ALUNORTE QUALITY MONITORING SYSTEM  
ALUMINA MONITORING

DAILY ALUMINA	WEEKLY ALUMINA	ANALYSIS CERTIFICATE	SUPPORT SYSTEM	INTERNAL SUPPLY
<input checked="" type="radio"/> ALBRAS	<input checked="" type="radio"/> ALBRAS	<input type="radio"/> DAILY ALBRAS	<input type="radio"/> OUT-OF-SPEC	<input checked="" type="radio"/> CAUSTIC
<input type="radio"/> CALCINATION		<input checked="" type="radio"/> WEEKLY ALBRAS	<input type="radio"/> SPECIFICATION	<input type="radio"/> FUEL-OIL
		<input type="radio"/> EXPORTATION	<input checked="" type="radio"/> TECHNICAL STARNDARDS	<input type="radio"/> STEAM TO WHITE SIDE
			<input type="radio"/> ALUMINA STORAGE AREA	<input type="radio"/> STEAM TO DIGESTION A
				<input type="radio"/> STEAM TO DIGESTION B

If a red number appears, then you have a quality problem, and you must click in to start the process scanning



Microsoft Excel - Stmqal32.xls

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Arial 10

**Alunorte**

**ALUMINA QUALITY MONITORING SYSTEM**

**MAIN MENU**

WEEKLY TO ALBRAS CALCINATION

**DAILY ANALYSIS ALUMINA TO ALBRAS**

VARIABLE	STATUS	VARIABLE	STATUS
<input type="radio"/> +100# GRAN	0,70	<input type="radio"/> Fe2O3	0,005
<input type="radio"/> + 200# GRAN	68,0	<input type="radio"/> TiO2	0,005
<input type="radio"/> - 325# GRAN	4,3	<input type="radio"/> Na2O	0,39
<input type="radio"/> SPECIFIC AREA	78,0	<input type="radio"/> ZnO	0,001
<input type="radio"/> LOI 300~1100 ° C	0,8	<input type="radio"/> CaO	0,003
<input type="radio"/> LOI 110~300 ° C	0,68	<input type="radio"/> V2O5	0,002
<input checked="" type="radio"/> LOOSE BULK DENS.	0,98	<input type="radio"/> MnO	0,001
<input type="radio"/> SiO2	0,015	<input type="radio"/> P2O5	0,0003



# The process scanning in progress



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Arial 9,5

## SEQUENTIAL GRAPHIC CONTROL ITEM

**MAIN MENU**

**CALCINATION**

**WEEKLY TO ALBRAS**

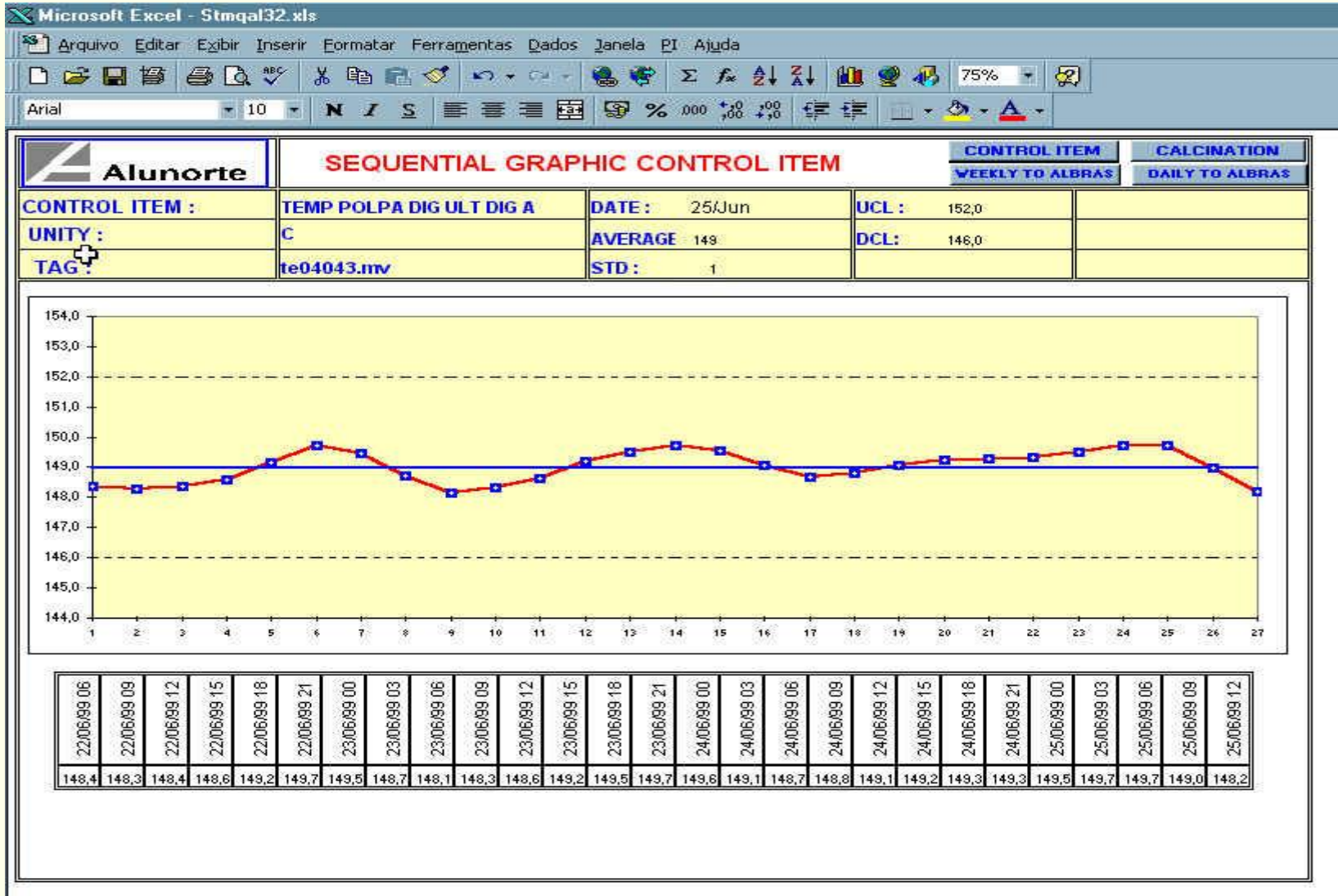
**DAILY TO ALBRAS**

<b>CONTROL ITEM :</b>	SI02 COMPOSTA CALCIIACAO	DATE: 25/Jun	TARGET: 0,025
<b>UNITY :</b>	%	AVERAGE 0,015	
<b>TAG :</b>	LT109ASLBB	STD: 0,001	


30/05/99 00	31/05/99 00	01/06/99 00	02/06/99 00	03/06/99 00	04/06/99 00	05/06/99 00	06/06/99 00	07/06/99 00	08/06/99 00	09/06/99 00	10/06/99 00	11/06/99 00	12/06/99 00	13/06/99 00	14/06/99 00	15/06/99 00	16/06/99 00	17/06/99 00	18/06/99 00	19/06/99 00	20/06/99 00	21/06/99 00	22/06/99 00	23/06/99 00	24/06/99 00	25/06/99 00		
0,017	0,017	0,017	0,016	0,016	0,015	0,015	0,015	0,015	0,015	0,015	0,014	0,015	0,016	0,015	0,014	0,014	0,014	0,014	0,017	0,016	0,013	0,014	0,014	0,016	0,014	0,018	0,015	0,017

TAG	VERIFICATION ITEM :	STATUS	VALUE	GO TO
te04043.mv	TEMP POLPA DIG ULT DIG A	●	148,3	
te04053.mv	TEMP POLPA DIG ULT DIG B	●	148,6	
tprddgca.mv	TEMPO RESID DIGESTÃO A	●	71,1	
tprddgcb.mv	TEMPO RESID DIGESTÃO B	●	69,7	
PT04045 .MV	PRESSÃO DIGESTOR GRD 04-5A	●	3,8	
PT04055 .MV	PRESSÃO DIGESTOR GRD 04-5B	●	3,7	

# The final level of the process scanning (fundamental variables graphics)







# Alumina Storage Monitoring System



- Allows continuous alumina storage monitoring, in real time, in order to detect quality deviations, due to storage process, in advance and allow proactive actuation by operational people
- Was used as support system to ISO 9.0002 Certification
- Totally developed by Alunorte's people
- Has been used mainly by operational people as a routinely tool to track alumina storage conditions

# Alumina Storage Monitoring System Main Screen




Microsoft Excel - PIARTICLEB001.XLS

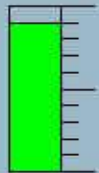
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**Alunorte** **ALUMINA MONITORING SYSTEM**

ALUMINA MONITORING SYSTEM


CHEMICAL HISTORY PHYSICAL

STATUS: 

Silos Storage 

HISTORY LAST ANALYSIS MAP

STOCK LAST WEEK CURRENT WEEK

STATUS: 

BLENDING STATUS %

Silo	50%	0%
1		0
2		0
3		0

Cancel

# Checking out the alumina quality at silos entrance



Microsoft Excel - PIARTICLE0001.XLS

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## Alunorte ALUMINA MONITORING SYSTEM

**CHEMICAL**   **HISTORY**   **PHYSICAL**

**STATUS** (Red dot)   **Silos Storage** (Green bar chart)

**HISTORY**   **LAST ANALYSIS**   **MAP**   **CURRENT WEEK**

**STATUS** (Green dot)   **BLENDING STATUS %** (Stacked bar chart)

**Physical features**

The last alumina analysis at calciner A, on 24/06/99, is :  
-325# = 6,6  
BET = 71  
LOI = 0,66

The last alumina analysis at calciner B, on 24/06/99, is :  
-325# = 4,6  
BET = 80  
LOI = 0,75

OK

# Checking out the total alumina received by silos in the day



Microsoft Excel - PIARTICLE8081.XLS

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## Alunorte ALUMINA MONITORING SYSTEM

ALUMINA STORAGE AREA

ALUMINA MONITORING SYSTEM

CHEMICAL HISTORY

HISTORY LAST ANALYSIS

Alhras

Cancel

Silo 1 inlet

Today the silo 1 has received, until now 3156 ton

By a period of 17 hs

OK

CURRENT WEEK

Silo	Value
2	50
3	50



# Checking out the delivered alumina quality



Microsoft Excel - PIARTICLE8081.XLS

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**Alunorte** ALUMINA MONITORING SYSTEM

ALUMINA STORAGE AREA

ALUMINA MONITORING SYSTEM

CHEMICAL HISTORY

Alumina delivered to Albras

	Last week	Current week
Na2O content	0,36 %	0,38 %
SiO2 conten	0,016 %	0,014 %
Fe2O3 content	0,006 %	0,006 %
-325#	4,6 %	4,4 %
BET	77 g/m <sup>2</sup>	76
LOI	0,8 %	0,8 %

OK

Cancel

ALUMINA STORAGE AREA

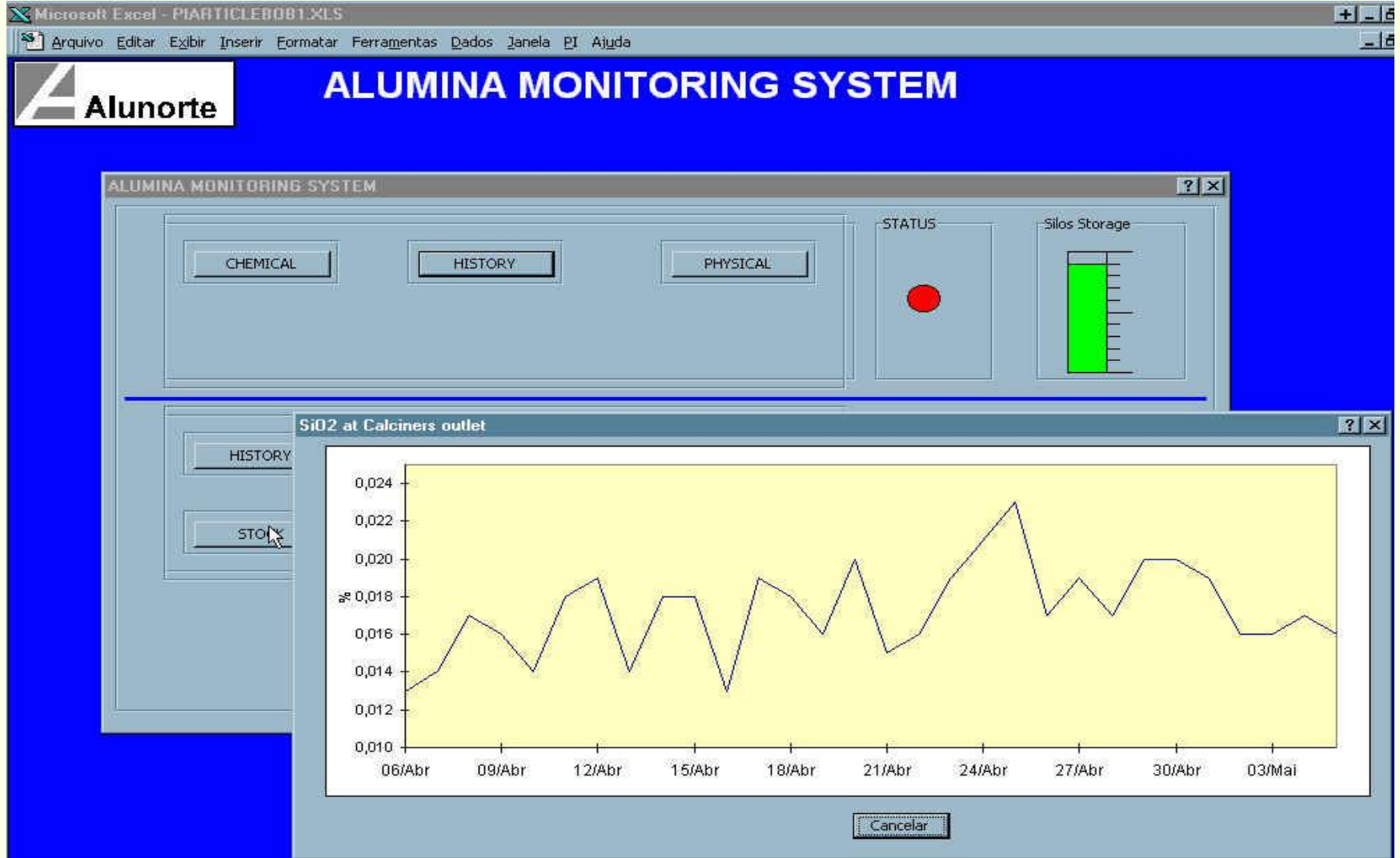
1 2 3

50 0 50 0

2 3

A schematic diagram of an alumina storage area. It shows three silos labeled 1, 2, and 3. Silo 1 has a green light above and below it. Silo 2 has a red light above and below it. Silo 3 has a red light above and a green light below it. Arrows indicate a flow from silo 1 to 2, and from 2 to 3. A ship icon is shown at the bottom right of the diagram.

# Checking out the alumina quality trend



# Getting an warning due alumina quality problems at silos entrance



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## Alunorte ALUMINA MONITORING SYSTEM

**ALUMINA MONITORING SYSTEM**

CHEMICAL HISTORY PHYSICAL

STATUS:

Silos Storage:

HISTORY LAST ANALYSIS MAP

STOCK LAST WEEK CURRENT WEEK

STATUS:

BLENDING STATUS %

Silo	50%	0%
1		0
2		0
3		0

**Inlet monitoring system**

Warning!.. It was detected that the SiO2 content at the calciner outlet is out of spec.

OK