Asset Performance Management

A SUCCESSFUL JOURNEY OF AVEVA™ PI SYSTEM™ AND AVEVA™ PREDICTIVE ANALYTICS ON MAINTENANCE IN BRAZIL

Presented by: Pedro Costa, Sandy Lopes & Rafael Cruz
Pedro Henrique Moura Costa
Sr. System Specialist
Norsk Hydro Brazil
Pedro.costa@hydro.com

Sandy Caroline Azevedo Lopes
Reliability Engineer
Norsk Hydro Brazil
Sandy.lopes@hydro.com

Rafael Cruz
Project Manager
Radix Engineering & Software
Rafael.Cruz@radixeng.com
Norsk Hydro
Norsk Hydro

Founded in 1905, Hydro has more than 118 years of history with around 32 thousand employees currently present in 40 countries.

Our purpose is to create a more viable society by developing natural resources into products and solutions in an innovative and efficient way.

We are across the entire aluminum value chain, from energy to bauxite mining and alumina refining, primary aluminum, aluminum extrusions and aluminum recycling.

OUR VALUES

Care
We act with respect for people and the environment and place safety at the heart of our operations.

Courage
We break new ground and take measured risks with agility, accountability and foresight.

Collaboration
We work as a partner internally and externally to unit competencies and create win-win opportunities.
We want to be at the forefront of industries that care about a more sustainable future.

Hilde Merethe Aasheim, CEO
Norsk Hydro

Global Sustainability Goals

In 2022 we produced our first near-zero volume aluminum

Climate Ambitions

Little or almost zero material by 2025 and 2030

30% emission reduction until 2030

Zero emission until 2050

Environmental Ambitions

1:1 Rehabilitation of available mining areas within two hydrological stations after the start of operations.

No net loss of biodiversity in new projects

50% reduction in the use of materials that emit greenhouse gases by 2030 (compared to 2018)
## Norsk Hydro Brazil

### Bauxite
- **Hydro Paragominas (100%)**
  - 11 millions tons per year
  - 244 km pipeline extension
- **11 millions production tons per year**

### Alumina
- **Hydro Alunorzte (62%)**
  - 6,3 million ton
  - Biggest Alumina Refinery outside of China
- **6,2 million alumina Production tons per year**

### Aluminum Metal
- **Albras (51%)**
  - Capacity: 460 thousand tons (100%)
  - Biggest producer of aluminum metal in Brazil
- **405 thousand tons primary metal production**

### Hydro Energy
- **Volumes Sold**
  - **300 MW**

### Hydro Extrusion
- **Three extrusion plants**
  - 84 thousand tons per year
  - Strong position in the Brazilian extrusion market
- **30.17’ tt**
  - Sales amount extrusion for external market

---

**Legend**
- **MW**: megawatt
- **TWh**: Terawatt-hour
- **Mt**: megaton
- **Mtpy**: megaton per year
- **Tpy**: ton per year
- **Km**: kilometer
Norsk Hydro Brazil
Technology, people, and Sustainability

The majority of our assets, operations, and employees are located in the state of Pará, in northern Brazil, specifically in the Amazon region – from bauxite extraction to alumina refining and primary metal production. That’s why we establish strict environmental control and monitoring standards, in addition to a structured and comprehensive process of engagement with neighboring communities.

- Hydro Bauxite & Alumina plants – Bauxite mining and Alumina Refinery
- Albras – Aluminium Metal process
- Hydro Extrusion plants and office – Final product to the market
- Hydro Energy
- Hydro REIN
- Administrative and Commercial Offices
Asset Performance Management
Norsk Hydro Brazil achieved a saving over than $4.7M on maintenance cost

Challenge

- High maintenance costs
- Premature asset scrappage
- Production losses due to asset failures
- A lack of readily available information and historical data

Solution

Implemented the first Hydro’s Asset Monitoring Center consolidating AVEVA™ PI System™ to streamline data collection, access, analysis, and reporting on maintenance perspective and deployed AVEVA™ Predictive Analytics for some critical assets

Results

- Achieved significant cost savings
- Costs avoided through asset failure anticipation based on notifications and operational routines
- Reduced human exposure to unplanned maintenance tasks
- Increased operational efficiency and safety
Challenge

What if premature failures could be avoided?

• Reactive maintenance
• High human resource working in emergency
• High risks
• High cost
How the APM works in Norsk Hydro Brazil

The entire approach focused on the Digital Transformation pillars
Centralizing system built with AVEVA tools

Solution architecture

**MONITORING ROOM**

VISUALIZATION

Asset Monitoring Center

AVEVA PI System

**CORPORATE SYSTEMS**

NON-REAL-TIME DATA

- Business Intelligence
- SAP
- Financial Data

**CORE**

BACKBONE

AVEVA PI System

**FIELD/CONTROL SYSTEM**

REAL-TIME DATA

- Remote and mobile assets
- IIOT gateways and sensors
- Automation and control systems

**INDUSTRY 4.0 TECHNOLOGIES**

- Predictive Models
  - AVEVA Predictive Analytics

- Real-time data
- Non-real-time data (corporate system)
- Specialist System to Predictive Maintenance
- Data infrastructure (Historian) - PI System
APM Monitoring Center

- Development center
- Monitoring of new alerts and deviations
  - Asset Analytics and Predictive Analytics
- Sending reports with KPI’s
- Direct communication with control room operators
- Forecast to determine maintenance window
- Guidance for industrial maintenance
Timeline

**DEC 2021**
Completion of proof of concept for the project on Alstom A and B boilers

**MAY 2023**
Predictive analytics testing on boiler fans

**JAN 2022**
Roll out of the development to other areas of the refinery

**MAR 2022**
Commencement of operations

**JUN 2022**
First success case: indication of critical instrument signal failure

**NOV 2022**
First indicators report released

**FEB 2023**
Installation of IoT vibration and temperature sensors

**JUL 2023**
Inauguration of the asset monitoring center
APM Numbers

4,000+ Assets monitored
57,659 Field TAG’s
16,981 Analyses

+$4.7M Cost avoided
50+ Success cases notified in one year
9,086 Notifications
Tools and resources used from AVEVA products

**AVEVA PI Data Archive** as the centralized industrial data storage infrastructure of the Asset Performance Management;

**AVEVA PI Server asset framework hierarchy** to enhance the data context from assets;
Resources

Tools and resources used from AVEVA products

**AVEVA PI Data Archive** as the centralized industrial data storage infrastructure of the Asset Performance Management;

**AVEVA PI Server asset framework hierarchy** to enhance the data context from assets;

**PI Analysis** as the engine to calculate:

- The reliability indicators from assets (uptime, downtime, MTBF, MTTR, others);
- The alerts generation to apply the CBM concept;
- The SQC on key variables.
### Event Frames

**Event Frame Searches**
- Event Frame Search 1
  - Aderência Risco
  - Equipamento Operando
  - PISAP - CriaNotaManutencao Agitadores
  - PISAP - CriaNotaManutencao Aqueducor
  - PISAP - CriaNotaManutencao Bomba Corrente do Motor
  - PISAP - CriaNotaManutencao Caldeira Eficiência
  - PISAP - CriaNotaManutencao Caldeira Nível
  - PISAP - CriaNotaManutencao Caldeira Produção de Vapor
  - PISAP - CriaNotaManutencao Caldeira Rendimento
  - PISAP - CriaNotaManutencao Chaminé Temperatura Gasos
  - PISAP - CriaNotaManutencao Ciclone Temperatura Togo
  - PISAP - CriaNotaManutencao Equipamento Elétrico
  - PISAP - CriaNotaManutencao Fornalha Pressão
  - PISAP - CriaNotaManutencao Mo看书 VIBRAÇÃO
  - PISAP - CriaNotaManutencao Parada Caldeira
  - PISAP - CriaNotaManutencao Transmisor
  - PISAP - CriaNotaManutencao TurboGerador Curva de Consumo
  - PISAP - CriaNotaManutencao TurboGerador Rendimento
  - PISAP - CriaNotaManutencao Ventilador Temperatura Mecan Ventilador L.O.A
  - PISAP - CriaNotaManutencao Ventilador VIBRAÇÃO L.O.A

**Transfer Searches**
- Transfer Search 1
Resources

Tools and resources used from AVEVA products

**AVEVA PI Notifications as the messaging solution to**
- Send email according to the rules of CBM created or prediction results from SQC Analytics;
- Open maintenance notifications on the ERP of Hydro automatically;
- Send periodic reports to the managers with reliability indicators and asset status;
Resources

Tools and resources used from AVEVA products

**AVEVA PI Notifications as the messaging solution to**
- Send email according to the rules of CBM created or prediction results from SQC Analytics;
- Open maintenance notifications on the ERP of Hydro automatically;
- Send periodic reports to the managers with reliability indicators and asset status;

**Dashboards** for online monitoring on AVEVA PI Vision.
Resources

Tools and resources used from AVEVA products

**AVEVA PI Notifications as the messaging solution to**
- Send email according to the rules of CBM created or prediction results from SQC Analytics;
- Open maintenance notifications on the ERP of Hydro automatically;
- Send periodic reports to the managers with reliability indicators and asset status;

**Dashboards** for online monitoring on AVEVA PI Vision.
DESAGUAMENTO - FILTROS HIPERBÁRICOS

FILTRO 3

PERFORMANCE

- UPTIME: 9,5 h
- DISPONIBILIDADE: 80,0%
- OEE: 9,0%
- DOWNTIME: 3,5 h
- TAXA UTILIZAÇÃO: 95,7%
- MTFB: 2,1 h
- MTTR: 0,5 h

PRODUÇÃO

- POTENCIAL: 2.342 t
- PRODUÇÃO (Realizada + Meta): 2.107 t
- PREVISÃO: 1.000 t

PARÂMETROS

- PIC-03C-118 (5,8 ~ 6,2 bar): 5,6
- Consumo de ar (3300 ~ 4200 Nm³/h): 5.299 Nm³/h
- Passos de 1 a 14 - Tempos Descarga: ON
- PIC03C117 (6 ~ 7): 8,0
- SIC03C101 (<= 2 RPM): 2,0
- LIC03C101 (> 90%): 87,8
- AT03C102 | Clarificador sol. (<100 µm): 5,5 mol/L
- DT03CD14 | Densidade entrada (1,45 ~ 1,47): 1,44 g/cm³
- HV-03C-125 "Aberta" & PT-03C-104 (>= 6): TRUE
- P-03C-5 | Status: 1
- A03C1 "Ligado" & Nível Tanque 4 (75 ~ 80): TRUE
- Filtrado (< 100): 700,0 mL
- Umidade (< 14,5): 14,5%

1 N° paradas

FILTRO
Últimos 3 desarmes

AGITADOR
Último desarme

Nível baixo do T-03-4
Resources

Tools and resources used from AVEVA products

**AVEVA PI Notifications as the messaging solution to**
- Send email according to the rules of CBM created or prediction results from SQC Analytics;
- Open maintenance notifications on the ERP of Hydro automatically;
- Send periodic reports to the managers with reliability indicators and asset status;

**Dashboards** for online monitoring on AVEVA PI Vision.

**Predictive approach on 4 assets** through AVEVA Predictive Analytics
Results
Achieved Results

+50
Early interventions within a one-year period

+$4.7M
Avoided Cost

- Maintenance Cost: $2.2M
- Asset Scrapping: $1.3M
- Production Loss: $1.2M
- Health, Safety and Environment: High Risk

Reduction in BPF oil consumption and coal consumption through improved equipment efficiency

Safety, reliability, and asset integrity

Increasing and monitoring process efficiency

Business Sustainability

Operational Robustness

Profitability

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.
Conclusion

How the right partnership can accelerate your results

Historical data on asset behavior, combined with process knowledge and best maintenance practices, along with technological advancements, are fundamental components for the development and growth of the industries.

From the development of the first proof of concept, we already believed in the feasibility of the solution. The engagement of various partners (maintenance area, production area, IT, automation) showed us how we could move faster and further.
Pedro Henrique Moura Costa
Sr. System Specialist
Norsk Hydro Brazil
Pedro.costa@hydro.com

Sandy Caroline Azevedo Lopes
Reliability Engineer
Norsk Hydro Brazil
Sandy.lopes@hydro.com

Rafael Cruz
Project Manager
Radix Engineering & Software
Rafael.Cruz@radixeng.com
Questions?

Please wait for the microphone.
State your name and company.

Please remember to...

Navigate to this session in the mobile app to complete the survey.

Thank you!
This presentation may include predictions, estimates, intentions, beliefs and other statements that are or may be construed as being forward-looking. While these forward-looking statements represent our current judgment on what the future holds, they are subject to risks and uncertainties that could result in actual outcomes differing materially from those projected in these statements. No statement contained herein constitutes a commitment by AVEVA to perform any particular action or to deliver any particular product or product features. Readers are cautioned not to place undue reliance on these forward-looking statements, which reflect our opinions only as of the date of this presentation.

The Company shall not be obliged to disclose any revision to these forward-looking statements to reflect events or circumstances occurring after the date on which they are made or to reflect the occurrence of future events.
ABOUT AVEVA

AVEVA is a world leader in industrial software, providing engineering and operational solutions across multiple industries, including oil and gas, chemical, pharmaceutical, power and utilities, marine, renewables, and food and beverage. Our agnostic and open architecture helps organizations design, build, operate, maintain and optimize the complete lifecycle of complex industrial assets, from production plants and offshore platforms to manufactured consumer goods.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life’s essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

Named as one of the world’s most innovative companies, AVEVA supports customers with open solutions and the expertise of more than 6,400 employees, 5,000 partners and 5,700 certified developers. The company is headquartered in Cambridge, UK.

Learn more at www.aveva.com

© 2023 AVEVA Group plc and its subsidiaries. All rights reserved.