Atlantic Operation Centre (AOC): The Foundation Towards the Best Operator to Overcome the Industry Challenges and Ensure Competitiveness

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Abstract

Refinery, smelter and casthouse operations continuously need to improve productivity in the more efficient manner to mitigate costs and ensure safety. These challenges can be undertaken by adopting a modern approach towards remote monitoring and operation systems. The initial steps involve the use of available and new set of data from intelligent and selected sensors to monitor our process and have real-time insights across diverse sectors, including safety and environmental management. By seamlessly integrating data platforms with sensor networks, industrial remote monitoring empowers operators to make better decision alone or with the help of remote experts to streamline the decision and enhance autonomy. In conclusion, industrial remote monitoring enables proactive decision-making, centralized management, and compliance with regulatory standards. This represents an undeniable approach to pave the way to improve productivity and sustainable operations and to remain a competitive industry in a safer work environment. This paper will present multifaceted benefits of industrial remote monitoring with specific use cases that illustrate its transformative impact.

Keywords: Real-time monitoring and remote operation, Alumina refinery, Aluminium smelter, Intelligent sensors, Data analytic and data-driven decision.

1. Introduction

In recent years, industrial operations, particularly in the aluminum sector, have faced increasing pressures to improve productivity, reduce costs, and maintain stringent safety standards. Additionally, smelter and casthouse operations face numerous challenges, including loss of experience due to workforce turnover, decision-making based on experience rather than standardized methods, loss of critical information at shift turnover, and escalation of minor problems to the technical team. These issues, alone or combined, affect operational stability and have driven all industries to adopt innovative solutions, such as remote monitoring systems and Lean management principles, to enhance their operational efficiency and competitiveness.

Indeed, remote monitoring systems have revolutionized industrial operations by providing real-time insights and enabling proactive decision-making based on process data and equipment performance. The integration of advanced technologies, such as IoT, machine learning and others, is well documented [1, 2] with the objective to improve real-time monitoring of industrial operations. It is understood that these approaches must first be initiated with an accessible data set or by the implementation of specific sensors. However, the goal is to optimize productivity and efficiency, reduce defects and costs and provide more visibility to daily challenges. In addition, a study by Gartner [3] highlights the transformative impact of remote monitoring systems on industrial operations. The report indicates that companies implementing these systems have seen improvements in operational efficiency, reduced downtime, and enhanced safety

measures. By providing operators with real-time data to enable quicker response times and more informed decision-making companies can achieve more stable and productive operations.

This article provides an overview of how Rio Tinto's Atlantic Operational Centre (AOC) contributes to operational stability across the Aluminum Value Chain through a collaborative approach and services platform. The success and sustainability of this approach rely on strong collaboration between operations teams, technical services, and the AOC team.

2. AOC Approach and Principles

The AOC's success and impact are based on three guiding principles. First, the objective was to establish clear and expected intervention criteria and timeframes. Second, the outermost importance was to define the exact roles and responsibilities and ensure that everybody understand their contributions. Third, the main goal was to continuously improve, and this required a way to measure the execution performance of standards.

The Lean management principles have been instrumental in driving operational efficiency and stability in various sector of the industry. Indeed, Lean management focuses on eliminating waste, optimizing processes, and continuously improving operations. In their research, Womack and Jones [4] illustrate that *Lean Thinking* can be effectively applied to industrial operations. They emphasize the importance of visual management tools, including performance review and standardized work procedures, in maintaining operational standards and ensuring that all team members have the same alignment with organizational goals. Consequently, the AOC also has similar foundations and operates on a Lean approach based on visual management, standards, and rituals, as illustrated in Figure 1.

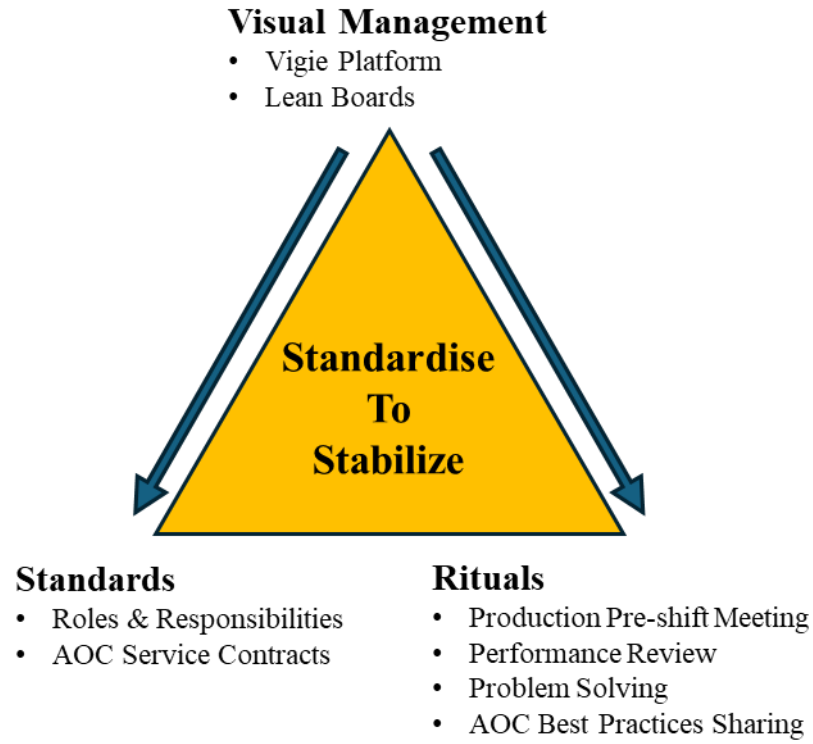

Figure 1. Diagram of the Lean approach based on visual management.

3. Vigie Loop Escalation System

The first two guiding principles are operationalized in the « Vigie Loop Escalation System » based on clear expectations and intervention procedures according to specific roles & responsibilities (Figure 2). The platform always sends the right information to the right person at the right time. The Vigie Loop Escalation System (VLES) consists of five intermediate loops supported by a dedicated team of analysts:

- **Loop 1:** *SMS to the operator:* To ensure that the operator has the necessary means to meet the technical standards. Should the problem persist, Loop 2 is automatically generated.
- **Loop 2:** *Inform the casthouse operation centre:* the analyst on duty diagnoses the issue using available data and collaborates with the senior operator to solve the problem.
- **Loop 3:** *Notice sent to Supervisor*: The analyst contacts the supervisor and summarizes the status, following Loop 1 and 2, to ensure further operational support.
- **Loop 4:** *Advise sent to the superintendent*: Immediate action is required to address the issue and communicate progress.
- **Loop 5:** *Alert sent to the head of plant operation*: Inform the managing responsible about the issue that could lead to process instability or production loss.

The VLES represents the corner stone of the AOC structure to address at the proper level various operational conditions and/or issues to assure a sustainable operational stability. Indeed, current research trends [5], on the digital transformation, highlight and confirm the increased integration of human intelligence with advanced technologies to improve adaptability and sustainability of industrial processes. It is worth mentioning that sustainable manufacturing represents opportunities to address present and future perspectives [6–9] under the digitalization process to achieve productivity, quality, but also supporting our quest for greener production.

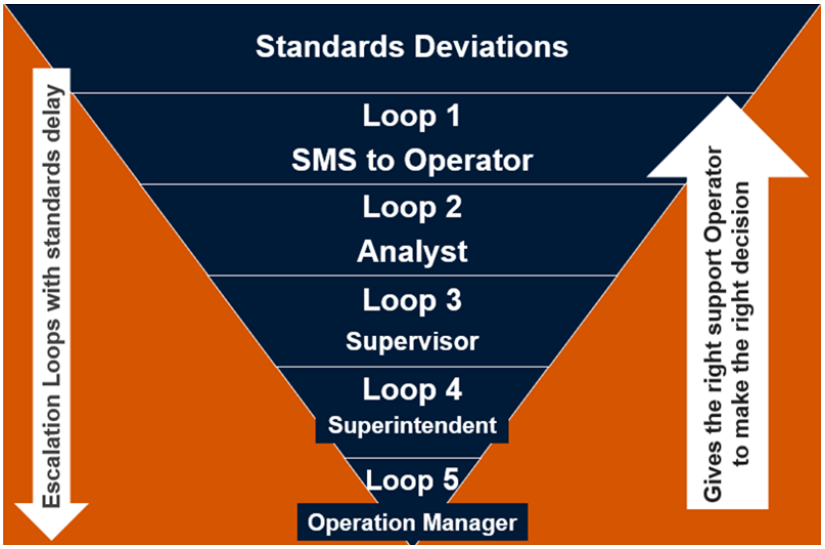

Figure 2. Diagram of the Vigie Loop Escalation System.

4. Execution Performance Standards Measure

Metrics are used to measure the execution performance of standards. The Work Quality Management System (WQMS) platform, developed for visual management on standard compliance, allows automatic real-time calculation of performance metrics. These metrics, previously calculated manually, are now easily accessible to operation personnel. This allows for a much quicker identification of areas that need support. The quick access to the right information

not only contributes to operational stability but also reduces stress on people as well as eliminates the bias associated with human interpretation.

Daily Performance Standard Measure Board

			2024-06-16 18:30 N (Q-1) -B		
Kpis Definition	Target	Unit	Sector 1	Sector 2	Sector 3
X1	39,00	(#)	20	39	34
X2	39,00	(#)	6	37	24
X3	90,00	%	71	85	92
X4	95,00	%	95	96	91
X5	90,00	%	94	81	96
X6	90,00	%	82	77	94
X7	95,00	%	96	96	91
X8	85,00	%	100	90	58

- Automatic updated during the shift
- Easy to access
- Used daily on Lean Rituals
- Escalation if needed
- Metrics available from operators up to managers

Figure 3a. Diagram of the Work Quality Management System (WQMS).

Monthly Performance Standard Measure Board

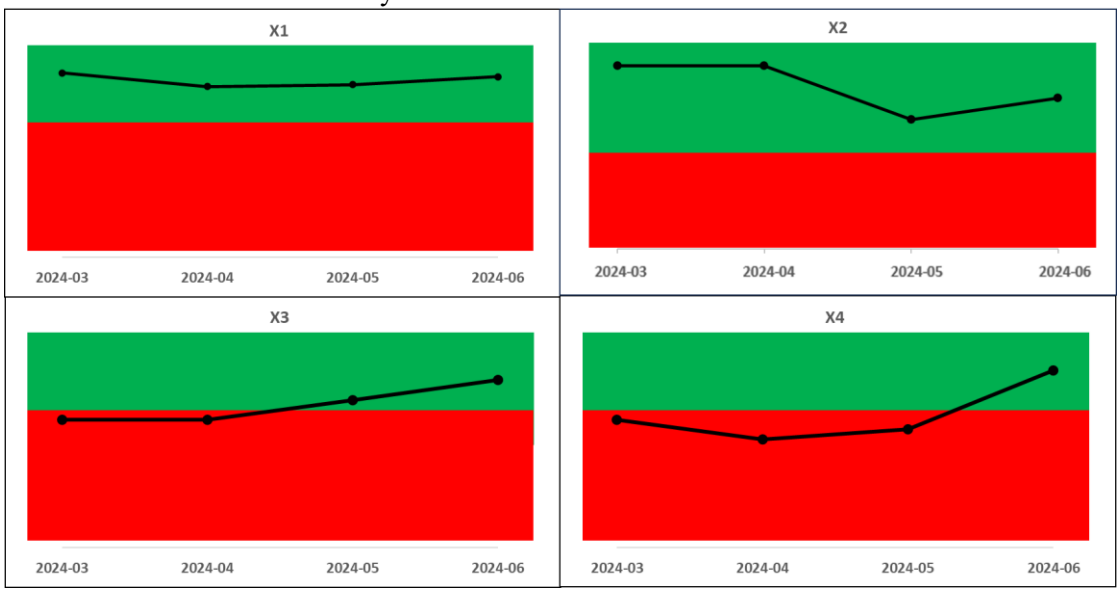

Figure 3b. Diagram of the Work Quality Management System (WQMS).

5. AOC Present Operation and Expansion

The AOC has been in service in Rio Tinto Aluminum (RTA) Atlantic since 2015 and continuously supported by a dedicated and dynamic team. More precisely, the AOC is in the Saguenay-Lac-St-Jean (SLSJ) region in Quebec, Canada, as shown in Figure 4. The AOC is articulated by a group of analysts on working shifts providing a continuous, 24 hours-7 days per week; technical support to the operations. Additionally, a specific AOC team that includes process experts, data analytic capabilities, data engineers supported by our IS&T group (Information Systems and Technology) is dedicated to developing new features and algorithms to better support our operation. This continuous improvement process is made across the entire value chain from raw materials to the final products and represent a logical digital transformation process already taken by the entire industry [10, 11].

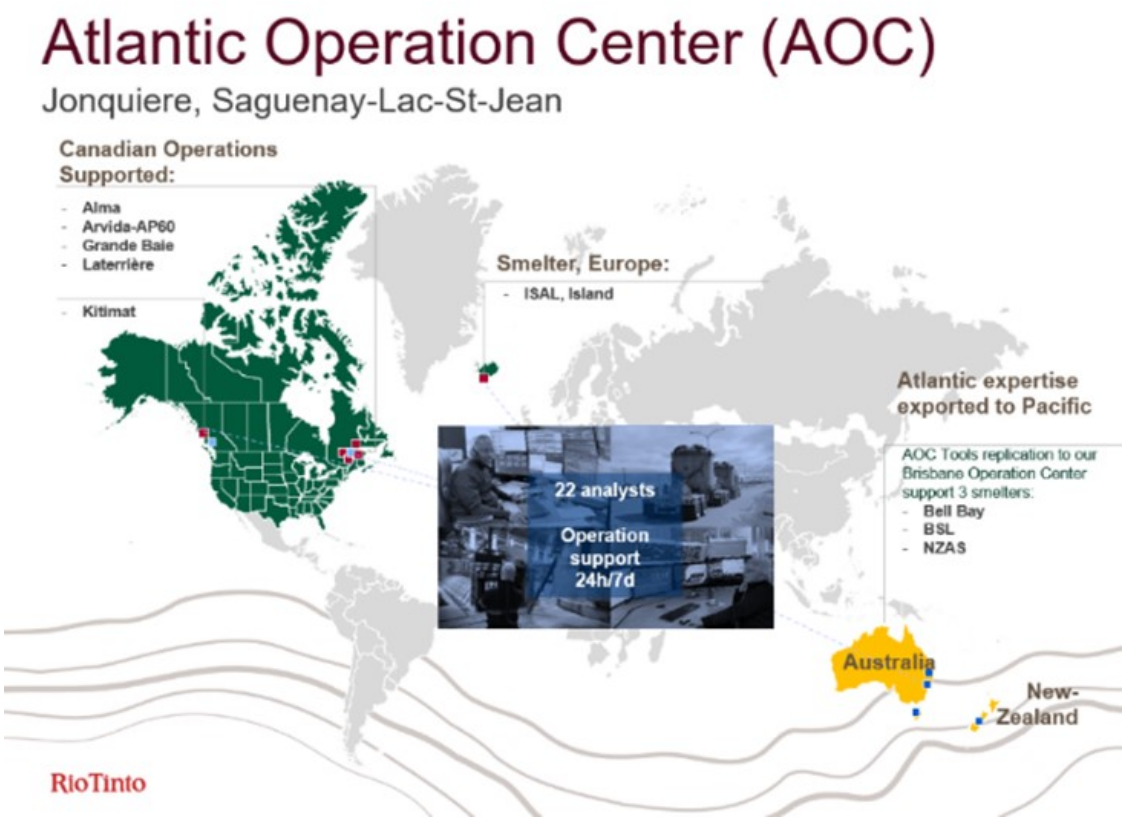

Figure 4. Atlantic Operation Centre (AOC) in SLSJ region and Pacific Operation.

It is worth mentioning that the AOC's primary mission is a rigorous follow-up on standards and automated data-driven decision-making. The AOC model and principles has been successfully exported to operational centre of Rio Tinto Aluminum Pacific in Brisbane, Australia. The Australian AOC-based centre is in operation since November 2022 to support the aluminium reduction plant operations at Bell Bay, Boyne Island in Australia, and NZAS plant in New Zealand. The technological approach and associated mindset make it logical to adopt and consequently were successfully transferred in less than a year.

6. Impact on Rio Tinto Atlantic Operations

The AOC's guiding principles have significantly impacted Rio Tinto Atlantic operations, enhancing productivity and sustainability across smelters and refineries in Canada.

The Aluminum Operation Centre is a vital component for becoming the best operator, focusing on operator stability, and guided by clear standards, well-defined responsibilities, and performance metrics. Continuous improvement and collaboration ensure that the AOC's philosophy and guiding principles permeate the organization, driving operational success and competitiveness.

In recent years, tools have been developed to manage all information and ensure its transmission to the right level of the organization. The VLES has been designed based on these main principles, as mentioned above, to establish clear expectations according to each role & responsibilities and measure standard compliance. This represents the fundamental of our operational centre where methods are centralized and rigorously managed. This approach ensures that the right information is shared efficiently to the different levels of the organization.

7. AOC Guiding Principles Impacts Overview on Rio Tinto Atlantic Operations

Rio Tinto's Atlantic Operation Centre (AOC) exemplifies the successful integration of remote monitoring systems and Lean management principles. Since its inception in 2015, the AOC has played a pivotal role in stabilizing operations across Rio Tinto's aluminum value chain. By leveraging real-time data and adhering to clear intervention criteria, the AOC has enhanced decision-making processes and improved operational stability.

The AOC is continuously expanding and now deployed in all aluminium smelters and refineries in Canada. Presently, the main streams that benefits from the platform are the carbon, reduction, casting, and the gas processing sector. At present, the development is now progressing towards new domains such as: refining, maintenance, power, process water management and liquid metal routing.

The overall aluminium production and casthouse operations have several sources of information. The AOC team works to channel all this information into our Vigie Loop Escalation System that represents the first step before the implementation of more advanced features towards remote operation.

All support calls conducted by the AOC analysts are categorized within our platform, allowing for automatic calculations of their impact on the production of our casthouses. Figure 5 illustrates the various categories of activities classified according to their metal volume impact. The AOC's activities related to batching monitoring, casting monitoring, and furnace temperature management have the most significant effects on our operational stability, resulting in an increase in metal production.

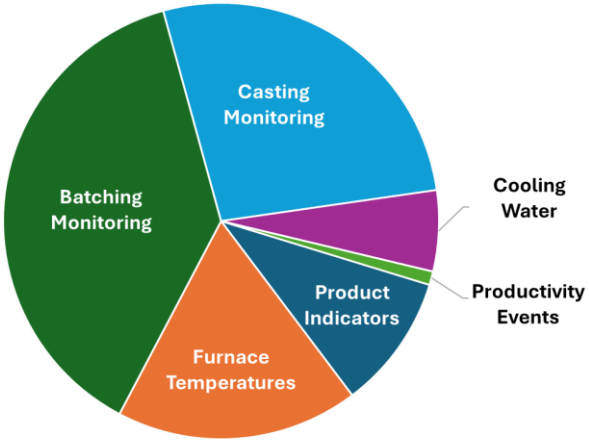

Figure5. AOC Volume impact per categories of intervention for Canadian casthouses.

Embracing this mindset significantly enhances the value of our operations. Figure 6 illustrates the outcomes achieved in one of our casthouses during the ramp-up of a melting furnace. For an extended period, temperature management was a primary contributor to our production losses. However, following the implementation of AOC remote monitoring, we improved our compliance with standards from 20–-30 % to a remarkable 100 %. This issue has been effectively resolved, enabling us to operate the furnace at the anticipated performance levels.

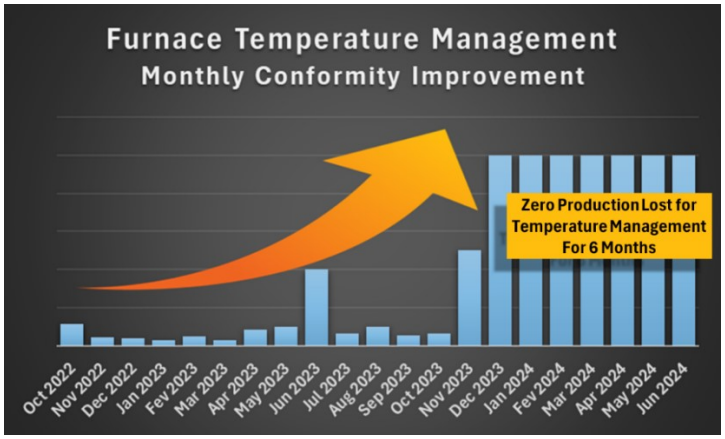

Figure 6. AOC monitoring resulting in a success rate of 100% in managing furnace temperatures and no production losses over a period of six months.

Figure 7 illustrates a notable impact, this time within our Gas Treatment Centre. The AOC remote monitoring system enables our operators to minimize the time required to address issues by identifying deviations in key indicators promptly and providing accurate diagnostics to resolve problems more efficiently. A comparison of the periods before and after this implementation reveals a 23% reduction in our gas fluoride peak emissions and a 27% decrease in our dust fluoride peak emissions.

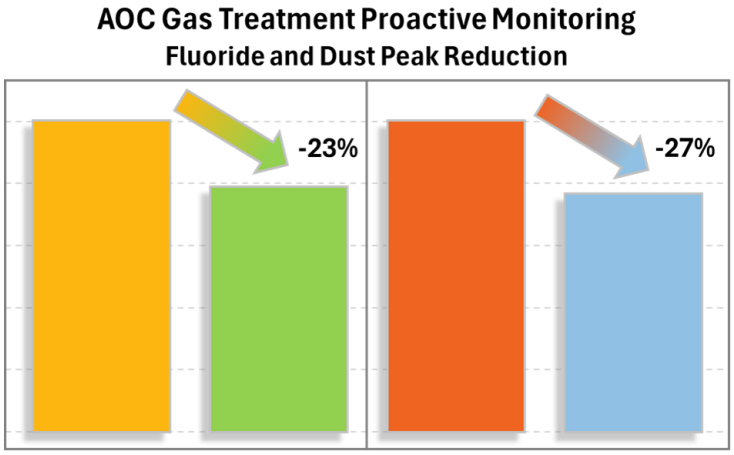

Figure 7. AOC impact of proactive monitoring on smelter fluoride and dust emissions.

8. Keys to Success in Change Management

Firstly, it is crucial for our managers to take ownership of these principles. Their commitment and active participation are fundamental to driving change effectively. Secondly, having a flexible platform to centralize all our business intelligence is essential. This platform needs to accommodate the diverse needs of our organization and support our operational goals seamlessly. Thirdly, it is imperative that all employees are integrated into the system to receive personalized services. This integration ensures that everyone is aligned and working towards common objectives.

Additionally, reliable, and accessible data, along with transparent communication between departments such as operations, technical services, and management are vital. These elements ensure that everyone is on the same page and that decisions are based on accurate information.
In summary the key success could be stated as:

- Ownership of principles by managers.
- A flexible platform to centralize business intelligence.
- Personalized service for all employees.
- Reliable, accessible data and transparent communication between departments.
- Continuous improvement to ensure the AOC principles are maintained.

At the AOC, our approach is to continuously improve to ensure that our philosophy and guiding principles are consistently reflected across the organization. For each recurring problem, we have a system in place for immediate follow-up. This includes automated tracking with metrics that measure execution performance. The AOC is responsible for replicating successful follow-ups across other sectors, ultimately impacting results, and maximizing our services' potential.
Our objective is to create value by focusing on the stability of our operators. We achieve this through three guiding principles: establishing clear standards, defining responsibilities precisely, and implementing metrics to measure execution performance.

During our deployment, which began in 2015, the implementation of the WQMS platform in 2017 marked a significant turning point. This platform has enabled us to see tangible improvements in our results and the impact of our collaborative efforts. However, the biggest challenge we have faced, and continue to face, is the change management. It was mandatory that our teams understand and embrace the new mindset, and see the operations centre as a supportive element, remains a critical hurdle. Indeed, the digital turn is a continuous process that needs robust and standardized measures of organisational readiness [12, 13, 14].

9. Testimonials

Implementing a collaborative system represents a daily challenge and success must be constantly monitored. The main goal is essentially to quickly improve the system and immediately address inefficiencies. Testimonials from different levels of users, including line managers and operators, are strong feedback that not only encourage the development team but certainly facilitate change management when rolling out new productivity tracking features.

- Manager Reduction, RTA operations: *"The WQMS platform is a tool I use daily. It is much more effective than the former tracking system and helps identify blind spots and recognize high-performing teams."*
- Superintendent Reduction, RTA operations: *"Using the platform for five years, it helps with prioritization, standard compliance, and team recognition."*
- Lead operator, Casthouse operations: *"The AOC aids my work, improves intervention speed, and saves time. It has great potential for continued improvement."*

10. Conclusions

It is believed that the Atlantic Operation Centre (AOC) represents a pivotal approach in becoming the best operator in the industry. With a focus on continuous improvement and adherence to our guiding principles, we are confident in our ability to overcome production challenges including the present challenges and achieve our goals. Thank you all.

The success of the AOC approach and its impact on operational stability highlights the importance of remote monitoring systems in modern industry. By adhering to its guiding principles, the AOC ensures continuous improvement and remains a competitive force in the aluminum industry.

Key Benefits of the AOC Approach:

1. **Proactive Decision-Making:** Real-time data enables operators to identify and address issues before they escalate, reducing downtime and maintaining operational continuity.

2. **Centralized Management:** A centralized approach ensures that all operational data is accessible and actionable, facilitating better coordination and oversight.
3. **Compliance with Standards:** Adhering to established standards and regularly reviewing performance metrics ensures consistent quality and safety across operations.
4. **Collaborative Environment:** The AOC fosters collaboration between different teams, enhancing knowledge sharing and collective problem-solving.

The integration of remote monitoring systems and Lean management principles offers a robust framework for enhancing industrial operations. By providing real-time insights, promoting proactive decision-making, and ensuring compliance with standards, these approaches enable companies to overcome operational challenges and remain competitive in a dynamic industry landscape. Rio Tinto's AOC serves as a compelling example of how such strategies can be successfully implemented to achieve significant improvements in productivity and operational stability.

11. Acknowledgements

We would like to extend our sincere gratitude to Rio Tinto and all the dedicated teams involved in this initiative. Your dedicated support and collaboration have been instrumental in driving the success of our change management efforts. The commitment and expertise you bring to the table have significantly contributed to our progress and the positive impact we have achieved. Thank you for your continued partnership and driving the excellence.

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