Solid Waste Masterplan: A New Approach for the Circular Economy in Alunorte Alumina Refinery

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Abstract

The alumina industry has a great challenge: the waste generated in the Bayer process and support areas. Several efforts have been made to find a more sustainable destination for the bauxite residue and the same approach is necessary for other types of waste. The method proposed here includes a more holistic view of waste management in order to advance the circular economy and the state of the art for waste destination related to process and support areas. At Hydro's alumina refinery Alunorte in Barcarena (Brazil), a multidisciplinary analysis involving a team composed of environmental, technical, and operational specialists identified process improvements to avoid waste generation and new potential routes for reinsertion in order to reduce the incineration and disposition of waste in landfills. New key performance indicators (KPIs) were also established and reported to support the corporate goals and strategy. The main results were new potential alternative destinations for other operational residues currently landfilled (beside bauxite residue), reduction of wasted lime, reinsertion of all hydrate out of specification, and development of markets for buying residue as a by-product.

Keywords: Circular Economy, Waste, Masterplan, Sustainability.

1. Introduction

Pursuing an environmental agenda is relevant in various contexts, particularly in the industrial sector. The industrial sector is constantly concerned with ensuring best practices. This paper discusses the case of Hydro's alumina refinery of Alunorte, in Barcarena (Brazil).

The development of a Solid Waste Master Plan aims to map the generation of waste in the refinery and based on that, to outline strategies to enable more sustainable alternatives for the disposal of waste sent to the Solid Waste Deposits (DRS) in the short, medium, and long term, so that the lifespan of the deposits can be extended.

The Master Plan tool should seek to reorganize the space in question or create a new expansion front without causing drastic changes in the existing context. In this regard, it is necessary to identify improvement opportunities and prioritize them, in order to define a set of activities that will ensure sustainable waste management.

Furthermore, it is worth noting that the proposed actions must be aligned with the objectives of the Brazilian National Solid Waste Policy (PNRS), Law No. 12,305/2010 [1], which as its main purpose aims to give waste the most appropriate final destination, according to its characteristics.

Usually, the standards for waste management are defined by the environmental team, while reduction targets are set in the operational area. The present article proposes a new approach for an integrated management and an optimum synergy across areas for a more sustainable solid waste masterplan.

2. New Methodology

The Solid Waste Master Plan (SWMP) has 6 phases (Figure 1). It begins with gathering information. The team responsible for conducting the activities collect and analyses all the available information regarding waste, for example: inventories, classification reports, Environmental aspect and impacts spreadsheet, procedures, and technical documents.

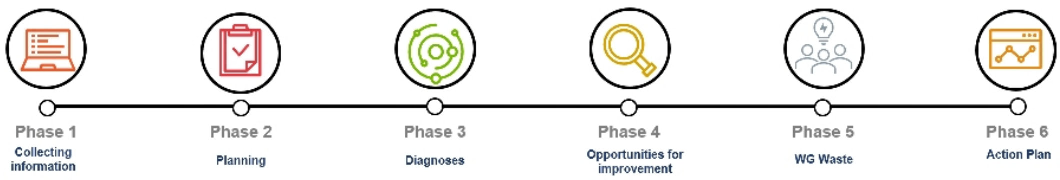

Figure 1. SWMP deployment phases.

Phase 1 consists also in a literature review tracking the best practices and mapping alternative destinations for each residue that are potentially more sustainable. The concept is to bring the academical knowledge closer to the operational team.

Phase 2 is the planning. A preliminary list of waste is made and will be the guide for the following phases and the fieldwork. The leadership of each operational area is engaged in the work and indicates the specialist to participate together with the technical and environmental teams. The chronogram and agenda are scheduled with a view to covering the whole refinery.

Phase 3 is the diagnoses. The meetings will take approximately 5 days per area. The operational area starts to present its process, with the focus to highlight any potential waste generation. The team describes each category of waste from cradle to grave. The Project Management Office (PMO) will highlight the synergies across the operation.

After the technical discussion, there is the fieldwork. Each type of waste should be checked in locus to confirm what has been discussed in the meetings and analysed from all perspectives, for example: the environmental aspects, how to avoid waste generation, any potential technical improvement, and the feasibility of the previously mapped potential of new destinations. After fieldwork, a wrap-up meeting is scheduled to consolidate and validate all the information and analyses made.

Phase 4 is the critical analysis of what has been identified in terms of potential improvements in waste management in the operational areas. This will form the base to gather all the expertise

3.4 New KPI

It is always important to set a parameter to evaluate the progress of improvements and action plans. The Solid Waste Master Plan proposes a new KPI (Key Process Indicators) based on the total amount of landfilled waste per production as shown in Equation (1)

$$KPI = \frac{\Delta Q landfilled\ waste\ (kg)}{\Delta Q\ production\ (tonnes)} \tag{1}$$

Where:

ΔQ landfilled waste: Total amount of landfilled waste.
ΔQ production: Total hydrate production

The new KPI helps to track which areas are performing better and which ones may need special attention to overcome challenges.

4. Conclusion

Alumina refineries all over the world have been engaging in activities that make alumina production landfill-free in the future, and it all starts with processes that we are already implementing today. The Solid Waste Master Plan has the potential to gather completely different departments across the company, from the more operational to the board, around the same goal. It is a fundamental tool for consolidating a robust roadmap for efficient waste management.

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