AA26 - Importance of Water Balance in an Alumina Refinery

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Abstract

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The Rusal Aughinish Alumina (AAL) refinery is located on Aughinish Island on the shore of the Shannon Estuary 33 kilometres west of Limerick city in the South West of Ireland. The plant commenced operation in 1983 and has a current production capability of 1.99M tons per annum. It sources bauxite predominantly from Guinea and Brazil and uses the Bayer process to produce alumina. For a chosen plant design and technology, production, costs and product quality can be optimised within the specific boundaries of the refinery. One of the key ingredients to deliver these optimum conditions is the management of the water balance in the refinery. Aughinish alumina refinery does not have a stand-alone evaporator as most alumina refineries would have so it fully relies on a tight water balance management. The contributors (inputs and outputs) to the water balance come from all process areas in the refinery, with some factors having a larger influence than others. There are a number of reasons why the water balance needs to be controlled and these reasons can be categorised into areas: deliver sufficient plant evaporation capability to achieve adequate tank movements in the precipitation circuit, optimisation of controllable caustic consumption and impurities management. The water balance is reviewed daily in the refinery and adjustments made to ensure the inputs are controlled relative to the outputs. The paper details how the water balance in an alumina refinery is managed.

Keywords: Alumina refinery, water balance, evaporation capability.

1. Introduction

Aughinish was commissioned in 1983 with a design capacity of 800 000 tonnes per annum. The refinery design was based on high quality dry CBG (62 %) and dry MRN (38 %) bauxites. The refinery was designed using the best available technology at the time: a Kaiser digestion design, an Alcan precipitation design and Alcoa calciners were installed. Aughinish was designed without a stand-alone evaporator. Evaporation capability is directly linked to processes such as digestion extraction, liquor cooling and heating, impurities concentration/removal. A single chain was built originally and today the refinery is still operating on that single chain, but the production capability has been increased to approximately 1.99 M tons per annum.
This paper looks at the main contributors to the water balance in the refinery. It details the impact of the main inputs and outputs as well as equipment changes that can have an influence. The role of the Process Control Group who review and make changes to the water balance on an ongoing basis is also discussed.

The water balance in the refinery can also be referred to as the plant volume and the terms will be used interchangeably throughout this document.

2. Water Balance is Part of the Process Flow Diagram of the Refinery

For the purpose of the water balance, an alumina plant may be considered as a large volume of liquor and solids that is contained in and circulated through a series of tanks and pipework. At various different points in the process, additions (inputs) and subtractions (outputs) are made [1]. Figure 1 below displays a boundary around the main areas within the refinery. The streams entering and exiting this boundary are the main inputs and outputs to the plant [2]. All these items contribute to the water balance within the plant. The Process Control Group must ensure that the inputs are controlled relative to the outputs. As the additions and subtractions are not always equal, there are some fluctuations in the water balance. Small fluctuations in the water balance can be tolerated as there is a small surge volume within the equipment but these changes need to be tightly controlled.

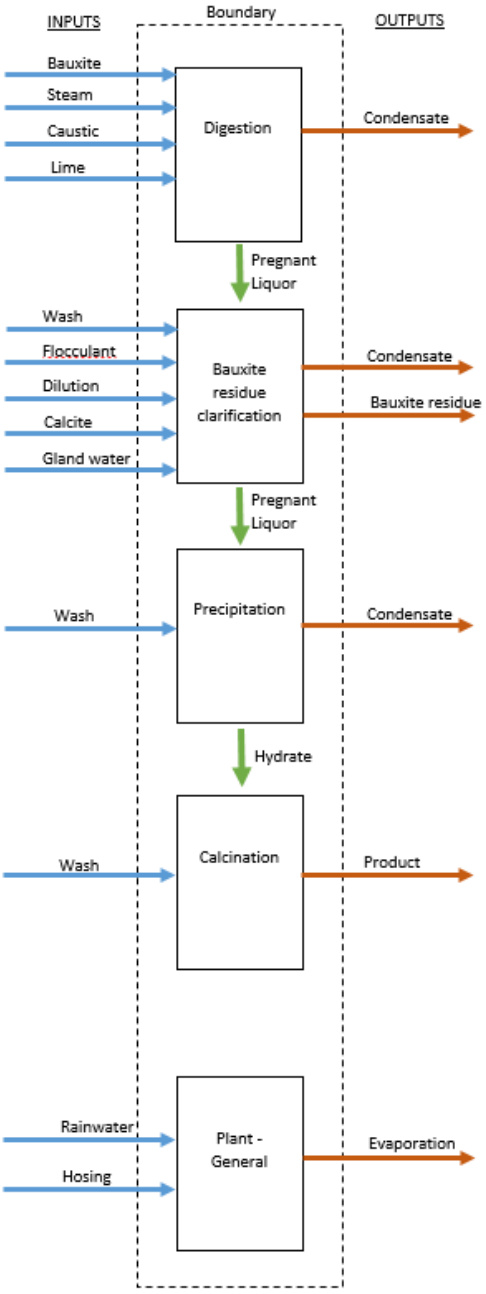

Figure 1. Water balance process flow diagram.

Indirect bauxite slurry heating is also an opportunity to eliminate the use of direct steam injection in the process.

11. Conclusions

The Aughinish refinery now operates at a much higher capacity than its original design but the primary equipment has predominantly remained the same. Combining this with the many constantly changing factors associated with the water balance makes it a challenging task for the Process Control Group to manage daily. It is critical that the water balance is kept in control not just from a safety perspective but also from a product quality and production perspective. New opportunities are constantly being explored that can reduce the water balance in the refinery. Any new options that change the water balance need to be considered carefully and the impacts on the different aspects of the refinery as discussed in this paper need to be assessed.

12. References

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