THE UNIVERSITY OF NEWCASTLE AUSTRALIA

TUNRA BULK SOLIDS

# Improvement of a Discharge System for Aluminium Hydrate

## Project Scope

**Bulk Material:** Aluminium hydrate, known to be a very abrasive material

**Equipment:** Existing metering valve used to discharge alumina into a pneumatic conveying system at a rate of 1 to 20 t/h. The valve operates via a conical plug moving up or down, thus changing the annular opening size and controlling the material discharge.

**Aim:** Unreliable feeding into the conveying system, leading to process interruptions, which has been an onging issue for 20 years.

**Goals:** Identify the reasons for unreliable material discharge and investigate possible solutions to overcome the problem.

## Strategy used by TUNRA Bulk Solids

### Analysis of the discharge issues:

Step 1: Getting un-biased information on the existing operational issues. The goal was to identify what is really happening in contrast to what the operators / engineers thought was happening.

Step 2: Investigate the flow properties of the specific material including material arching dimension, compressibility, cohesiveness and flowability.

Step 3: Relate the results of flow properties with existing design and operation procedures to identify the issue.

### Investigate Solutions

The client asked for the following four options to be investigated. Manufacturers of screw conveyors and rotary valves all claimed that their system is the best for this application.

1. Improvement to the existing equipment design
2. Replacement by a screw conveyor
3. Replacement by a Fuller-Kinyon TM pump
4. Implementation of a Lisbon rotary valve

## Project Outcomes

### Material arching occurred in the metering valve

The client always assumed that the discharge issues do not result from the metering valve operation but from material arching in the feed hopper. Therefore, air jets had been put in place in this hopper to break the material bridges. The investigation revealed that the annular opening of the metering valve was too small for the aluminium hydrate, resulting in material arching across the opening. The circular orifice was 70 mm when fully opened while flow property testing showed that the material's critical arching dimension is 120 mm.

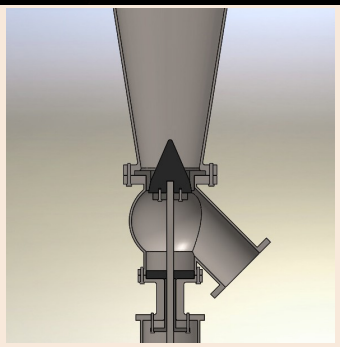

Figure 1: Existing metering valve

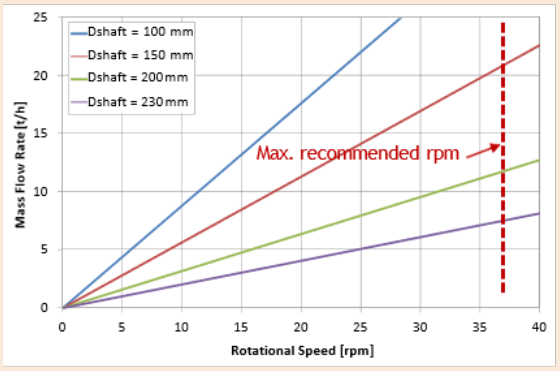


Figure 2: Calculation of the operative curve for a rotart valve with 350 mm diameter

Replacement of the discharge system was the only solution. Using a screw conveyor was not recommended due to the great size of the screw required to avoid material arching and the resulting very low screw speed to achieve the desired low range of throughput. A Fuller-KinyonTM Pump was found to not have any benefit for this application while having high risk of blockage, high maintenance issues and high power consumption. Using a rotary valve was found to be the most suitable solution to replace the current system, although wear must be considered.

## Advancing the Bulk Materials Handling Discipline Globally

For further information:
www.bulksolids.com.au
enquiries@bulksolids.com.au
Or phone TUNRA Bulk Solids
+61 2 4033 9055