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Elutriation – A Novel Way of Solving a Screening Problem

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Abstract

The trommel screens on Namdeb's Floating Treatment Plant (FTP) provide the first stage classification for the feed stream from the dredge. The oversize material reports to the DMS circuit while the undersize reports to the reject pumping system. The trommel screens were unable to cope with the amount of fine material from the dredge resulting in fine material reporting to the DMS circuit.

An elutriator was installed on the FTP to reduce the amount of fine material reporting to the trommel screens. The 2.4 m diameter and 12.5 m high elutriator was commissioned in October 1999 thereby significantly increasing the tonnage that can be treated by the FTP.

The paper describes a unique application of hydrotransport technology to solve a process plant problem. The development of the elutriator concept, model evaluation, design parameters and commissioning is presented.

1. Introduction

Namdeb Diamond Corporation commissioned the Floating Treatment Plant (FTP) to screen out and concentrate gravels from the Beachcomer overburden dredge in 1996 (shown in Figure 1). The installed trommel screens proved to be inadequate to achieve the primary screening requirements at 2 mm apertures. Namdeb investigated a number of options for solving the screening problem. Conventional screening was not feasible as a separate screening barge would have been required at an exorbitant cost.

Namdeb approached Paterson & Cooke Consulting Engineers (PCCE) with the concept of reducing the trommel screen duty by splitting the flow stream from the dredge to remove

fines from the screen feed. PCCE proposed the elutriation concept which lead to the concept being jointly developed and engineered by Namdeb, PCCE and De Beers CHQ.

This paper describes the elutriator concept, test work conducted to verify the concept, design parameters and system commissioning.

Figure 1: Beachcomer Dredge and Floating Treatment Plant

2. Elutriation Concept

The elutriator's operating principal is illustrated in Figure 2. The feed from the dredge is split into two streams. The underflow reports to the trommel screens and the overflow by-passes the screens and reports directly to the screen underpans. The overflow stream flows vertically upwards through the elutriator column. The upward velocity in the column is monitored using a magnetic flow meter and controlled to a set value using a flow control valve. Particles with settling velocities greater than the column rise velocity fall to the bottom of the column while smaller and lighter particles rise to the top of the column. The nominal cut size is a function of the column rise velocity.

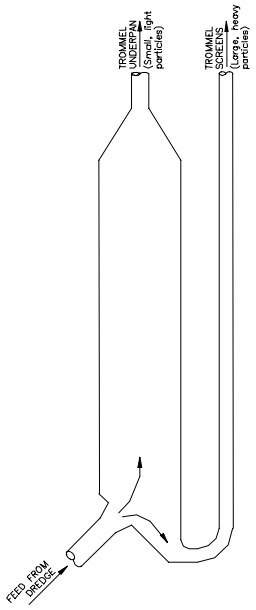

Figure 2: Elutriator Operating Principle

3. Pilot Plant Trials

Pilot plant trials were conducted in September and October 1998 to prove the concept, evaluate various inlet and column geometries and establish design parameters for the full size unit.

The main findings of the test work are:

- The performance of the elutriator is not affected by the solids concentration in the feed stream for the range of expected operating solids concentrations (up to 42% by mass).
- Of the various inlet geometries tested, a 45 degree inlet with a sudden transition as illustrated in Figure 2 gave the best performance. This was also the most convenient configuration for the prototype installation.
- The tonnage of material reporting to overflow increased linearly with the percentage of feed mixture flow rate reporting to overflow.

The tests were conducted using a transparent acrylic 300 mm diameter elutriation column. Observation of the flow behaviour inside the column improved understanding of the flow mechanisms. This assisted greatly with subsequent modifications to the model elutriator during the test work and reduced the development time required for the project.

4. Namdeb Floating Treatment Plant Elutriator

The basic design specification for Namdeb's Floating Treatment Plant (FTP) is:

- Nominal design tonnage: 2 500 t/h (1 200 t/h minimum and 3 000 t/h maximum).
- Nominal design flow rate: 5 200 m^3/h (4 800 m^3/h minimum and 5 500 m^3/h maximum).
- Maximum particle size in feed stream: 150 mm.
- Maximise the percentage of all material finer than 2.36 mm reporting to overflow.

The elutriator designed for the treatment plant has an internal diameter of 2.35 m and a total height of 12.725 m. The nominal diameters of the feed, overflow and underflow pipes are 600 mm, 500 mm and 400 mm respectively.

It was fortunate that there was suitable space on the FTP to retrofit the elutriator. Nevertheless, it took some careful engineering to integrate the elutriator with the existing plant equipment. Figure 3 shows the base of the elutriation column during installation on the FTP.

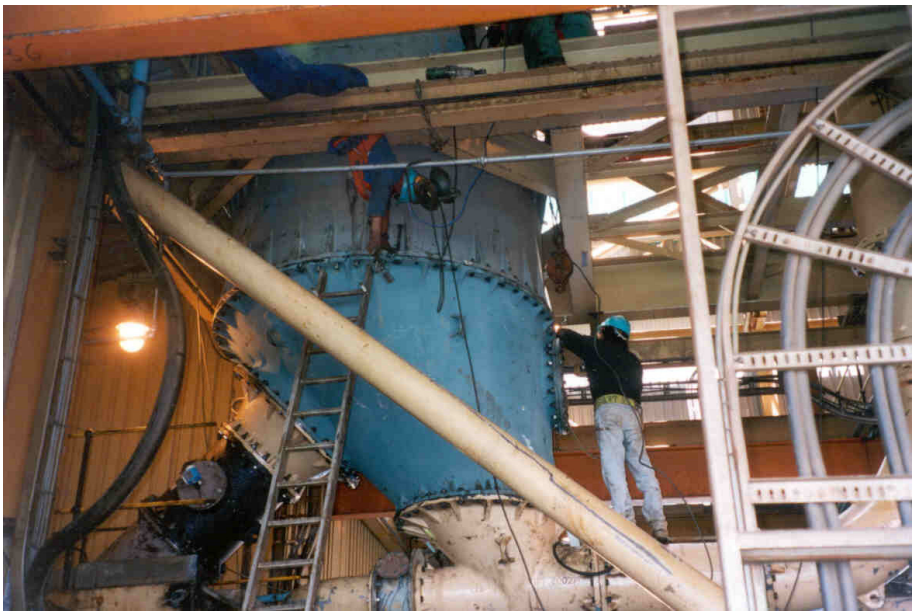

Figure 3: View of the Elutriator Base During Installation

5. Commissioning and Operation

The elutriator was successfully commissioned during October 1999 without any major problems. Figure 4 compares the expected and guaranteed elutriator performance with measurements recorded during commissioning. The elutriator exceeds the expected performance by a significant margin.

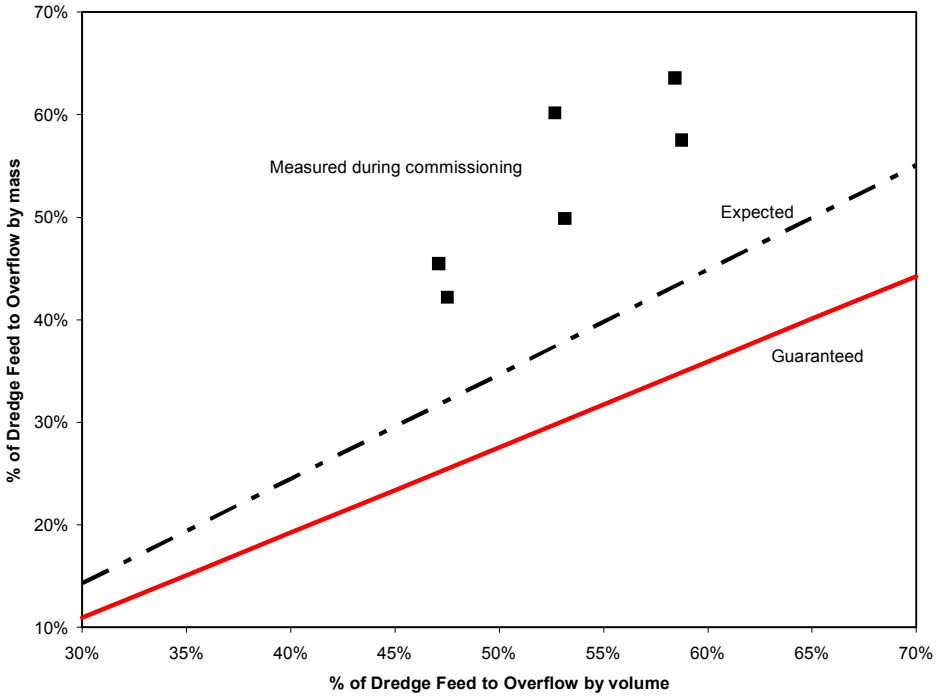

Figure 4: Elutriator Performance

6. Conclusion

The elutriator concept has provided a novel solution to the screening problem on Namdeb's Floating Treatment Plant. The FTP elutriator performance exceeds the specified design requirements and has been operating successfully late 1999.

Acknowledgements

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