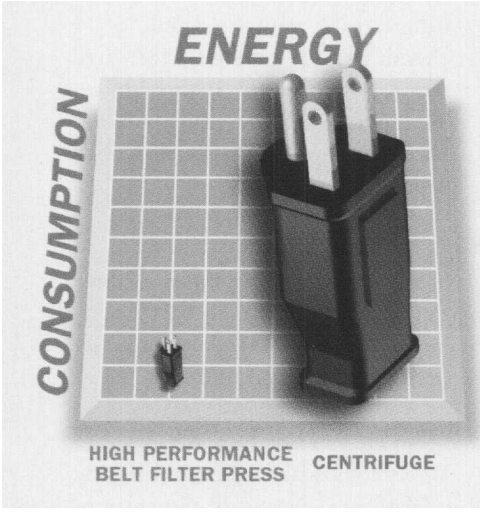
Belt Filter Presses
Still a Cost-Effective Solution

During the last decade, many wastewater treatment facilities saddled with aging, less-than-efficient dewatering equipment responded to claims that centrifugal technology was the answer to their dewatering needs of increased efficiency, simplicity of operation and less use of space.

Centrifuge manufacturers presented evidence showing that their equipment achieved a high solids-capture rate of 90–95 percent and a cake dryness level of 30–35 percent. It already had been established that high-performance belt filter presses achieve similar results, but centrifugal technology, it was promised, would be simpler to operate, while requiring less space.



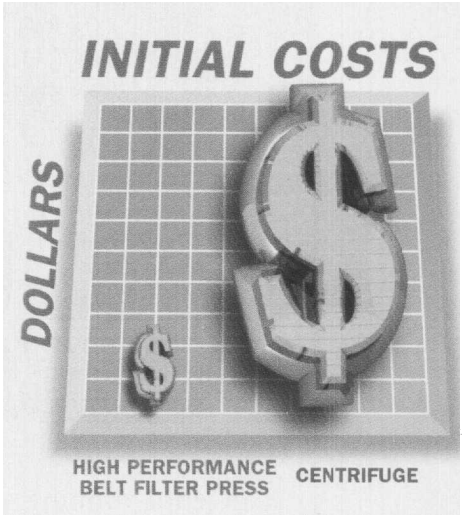
Numerous facilities responded by adding centrifugal equipment. And why not? Centrifuges were easy to understand. The equipment only has a couple of large moving components. In addition, tests showed that dewatering results were in acceptable ranges.

As a result, capital outlays were made, based on assurances from the major centrifuge manufacturers of excellent returns on investment relative to performance and operational savings.

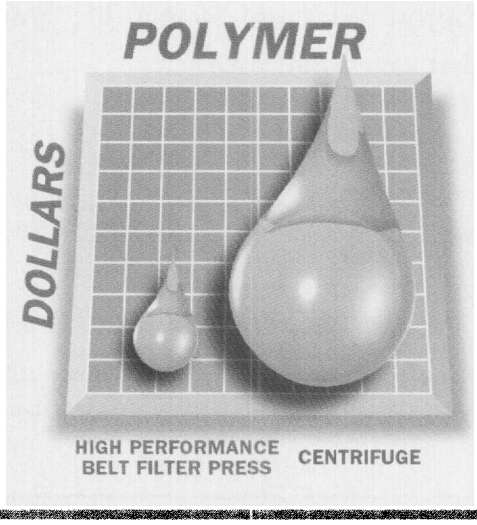
Efficiency and Cost-Effectiveness

It did not take long for wastewater treatment system operators to note that, although promised levels of cake dryness were achieved with centrifugal systems, efficiency of operation and long-term fiscal benefits were suspect.

Five primary areas of concern arose.



- It was found that capital outlays for centrifugal equipment are in the range of three to four times as much as for high-performance belt filter presses (BFP). On average, a centrifugal system cost from $750,000 to $1 million. A high-performance BFP cost in the range of $175,000 to $300,000.
- To achieve overall similar results, power consumption for centrifugal dewatering operations was found to be ten times the amount required for high-performance belt filter presses. Centrifuge technology relies on high-horsepower motors (often in the 200 hp range, compared to 20 hp or less for BFPs) to create sufficient centrifugal force to "press" the water from the sludge. This unleveraged use of power requires tight-tolerance components for desired capture rates, contributing to the excessive power drain. The load on giant centrifuge motors can become so great that when there is an interruption in power, the centrifuge unit has to be brought to a complete stop, and all sludge material has to be physically removed (by hand) before the units can be restarted.



- To achieve cake dryness of 30 percent or greater, centrifugal systems require at least three times the polymer of a high-performance BFP, at a proportionately greater

cost. The excessive polymer usage is required because particulate with low specific gravities does not respond well to centrifugation. The process has to depend almost entirely on artificial flocculation agents (polymer) to reach promised dryness levels.

- It was found that centrifugal systems require significantly greater maintenance than BFPs. Centrifuge downtime also is significant since most normal repairs must be done at remote facilities having specialized manpower and equipment. Typically, maintenance on centrifuge units is characterized by major capital outlays every five years or so, whereas maintenance on BFPs is usually accomplished with regular, preventive maintenance
- Cake produced by centrifuges is less consistent than BFP cake. Centrifugal cake varies in bulk consistency (lbs./ft.^{2}). These variances are in different ranges from machine to machine, and from operator to operator. This makes it harder to post-condition centrifugal cake with lime and other chemicals. In general, centrifuge return solids create higher sludge inventories within the plant, with the attendant problems associated with light, bulking solids.

Field Tests

Side-by-side tests performed in three major dewatering facilities showed the difference in power and polymer costs between centrifuges and BFPs.

Western Dewatering Facility:

Direct-comparison tests initiated by Ron Matheson, director of plant operations, Vallejo Sanitation and Flood Control District, determined that the centrifuge required $19,000 annually in power, while the BFP required $4,000. Polymer cost for the centrifuge was $49.36/dry ton; for the BFP, $14.33/dry ton. This translated into yearly polymer costs of approximately $241,000 for the centrifuge, $96,000 for the BFP.

During the test, capture for the centrifuge was an average 94 percent; for the BFP, 97 percent. The centrifuge produced cake solid averaging 29 percent, the BFP 32 percent.

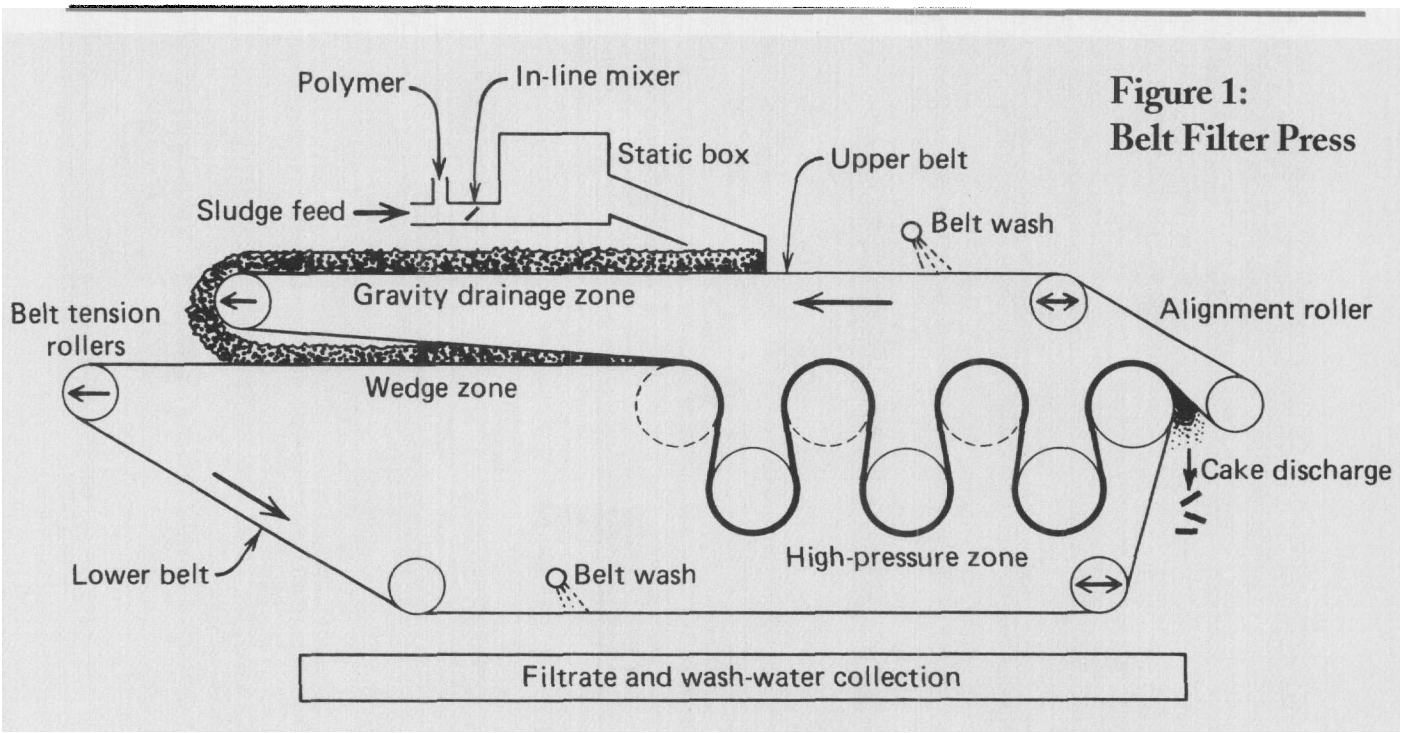


Figure 1: Belt Filter Press

Total annual operating and maintenance costs for the centrifuge (including odor control, power, chemicals, labor and materials) were calculated to be $5.344 million; for the BFP (using similar parameters) $3.571 million. Taking into account that capital costs for the centrifuge were $2.250 million and for the BFP $1.050 million, total first-year costs were calculated at $7.594 million for the centrifuge, $4.621 million for the BFP.

According to the commissioner's conclusion: "When the higher operational costs for the centrifuge were included in the present worth analysis, it became evident that the belt press was the more economical choice."

Northeastern Dewatering Facility:

This study, conducted for Middlesex County, New Jersey, managed by Alan Jacobs of Jacobs Environmental, consisted of side-by-side tests of six high-performance BFPs and four centrifuges.

Annualized total power cost for the six BFPs was $186,000, for the four centrifuges, $346,000. Annualized chemical cost for the six BFPs was $921,000, for the four centrifuges, $1,545,000.

The commission's conclusion: "For operation and maintenance, the BFP has a significant cost advantage over the centrifuge. The major components of the centrifuge's higher operating costs are higher polymer usage and higher power consumption."

Furthermore, the commission stated that the Ashbrook equipment used in the test "offers continuous reliable operation with minimum operator attention. Large, multi-press installations are typically operated with as few as two operators per shift."

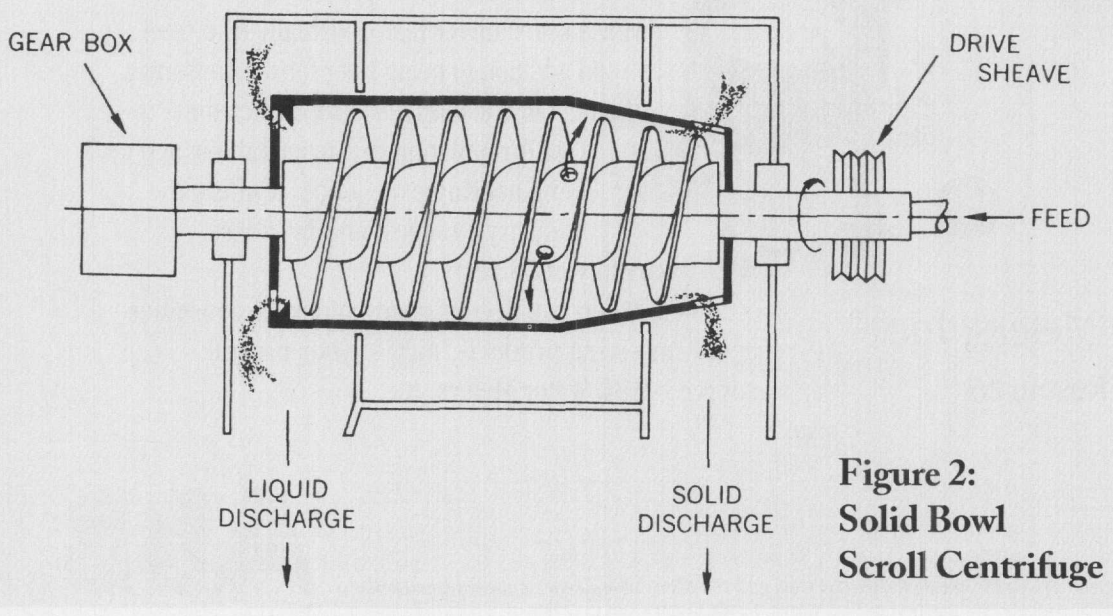


Figure 2: Solid Bowl Scroll Centrifuge

Midwestern Dewatering Facility:

In Central Weber, Utah, David Miklas of Montgomery Watson conducted direct tests between centrifugal and BFP technology focused primarily on chemical costs. Side-by-side tests showed that the centrifuge required $26.80 in polymer per dry ton. The high-performance BFP used $22 per dry ton.

The results of this comparison also

determined that under certain circumstances, the BFP was able to more efficiently handle a larger throughput than the centrifuge. This was found to be the result of the centrifuge's inability to efficiently utilize polymer to achieve the target percentage of cake dryness. Throughput for the centrifuge was found to be 250–700 lbs/hr. Throughput for the BFP was 400–1,200 lbs/hr.

Centrifuge Marketing

Even though high-performance BFPs are similar to centrifugal technology in influent throughput and cake dryness, during the last decade centrifugal systems have eroded the market share of many other types of dewatering equipment. Centrifugal systems made initial inroads into many dewatering facilities through the use of marketing strategies focusing on recognizably cosmetic needs and issues. However, certain elements of centrifugal design dealing with efficiency and costs of operation may not have been made known to prospective customers. Many municipalities that purchased centrifugal dewatering systems have recognized that, while the systems were able to achieve respectable results, they did so at a significant increase in cost.

Even if operating costs of the two systems were inherently comparable, capital costs of the equipment are not. With the average centrifuge costing $750,000 to $1 million and the average high-performance BFP costing around $175,000 to $300,000, the difference in initial financial outlay could easily pay for any additional space requirements of BFP systems.

Summary of Direct Head-to-Head Tests

The direct tests proved what analysis of dewatering facility operational costs had already shown.

- Capital outlays for centrifugal equipment are higher than for high-performance BFPs.
- Power consumption for centrifugal dewatering operations was found to be as much as ten times the amount required for high-performance BFPs.
- Centrifugal systems require up to three times the polymer required by a high-performance BFP.

Cost-Effective Solutions

Wastewater operations are returning to quality, high-performance BFPs to achieve reliable, cost-effective dewatering. In a recent survey, several operators confirmed that they already had or were in the process of installing high-performance belt filter presses in their facility to replace their centrifuge equipment.

About the Author
This article was written by Ashbrook Corp. with test help from the Vallejo Sanitation and Flood Control District, Jacobs Environmental and Montgomery Watson.

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