News Flash 10

Section: Waste Water Treatment: Centrifuges 1

Report about the prevention and removal of scale with the aid of the "**Scale***watcher*®"

1. The company In one of the wastewater treatment plants (North End Sewage Treatment Plant) of Winnipeg (photos 1 and 7), a city with 600,000 inhabitants, the sewage sludge has its water removed in a number of de-watering centrifuges. After that, the water is purified further and then discharged, while the sludge is removed.

2. The process

The purification of the sewage sludge occurs in the sludge de-watering centrifuge, in which the centrifugal force separates the sludge from the water. This is possible because sludge is heavier than water.

3. The problem

Struvite, a hard crystalline deposit which consists of magnesium and ammonium phosphate typically forms and covers the inside of the sludge de-watering centrifuge (photo 2). These mineral components are found in all sewage slurries, which contains water. The struvite will form a solid deposit when the sewage sludge is de-watered, as the solubility limit of the magnesium is reduced. The manager of the plant, Mr Jim Main, explained that the struvite problem had existed for more than five years. After every 800 hours of operation (approximately 2 months) the centrifuge had to be stopped to be cleaned of the solid struvite deposits. This consisted of cleaning the centrifuge wall free of struvite, which took two people one day with chemicals, a hammer and chisel.

4. The solution

Centrifuge number 5 (photo 2) was chosen for the test. A **Scale***watcher* ® Industrial unit was placed at the centrifuge with an induction cable around the 6" supply mains (photo 3). When the treated centrifuge was opened during the first inspection after four months, it appeared that the wall was only covered with a minimal deposit of softened struvite. Two months later the centrifuge was opened and inspected again. The same result could be seen, except that this time the difference was that the wall was even cleaner (photo 5). Struvite deposits prior to installing **Scale***watcher* are shown in photos 4, 6 and 8.

Then, it was decided to run two centrifuges simultaneously, one treated with **Scale***watcher* ® and one untreated. Two months later, both centrifuges were opened for inspection and both were clean. Another inspection was done again two months later, with the same results. To be completely sure that the **Scale***watcher* ® had solved the struvite problem, it was decided to switch off the **Scale***watcher* ® and in this way check whether the struvite deposit would return. It was observed that the struvite deposit had indeed appeared on the wall of the centrifuges again. After that the **Scale***watcher* ® was switched on again and since July 1996 no more deposit of struvite has been observed.

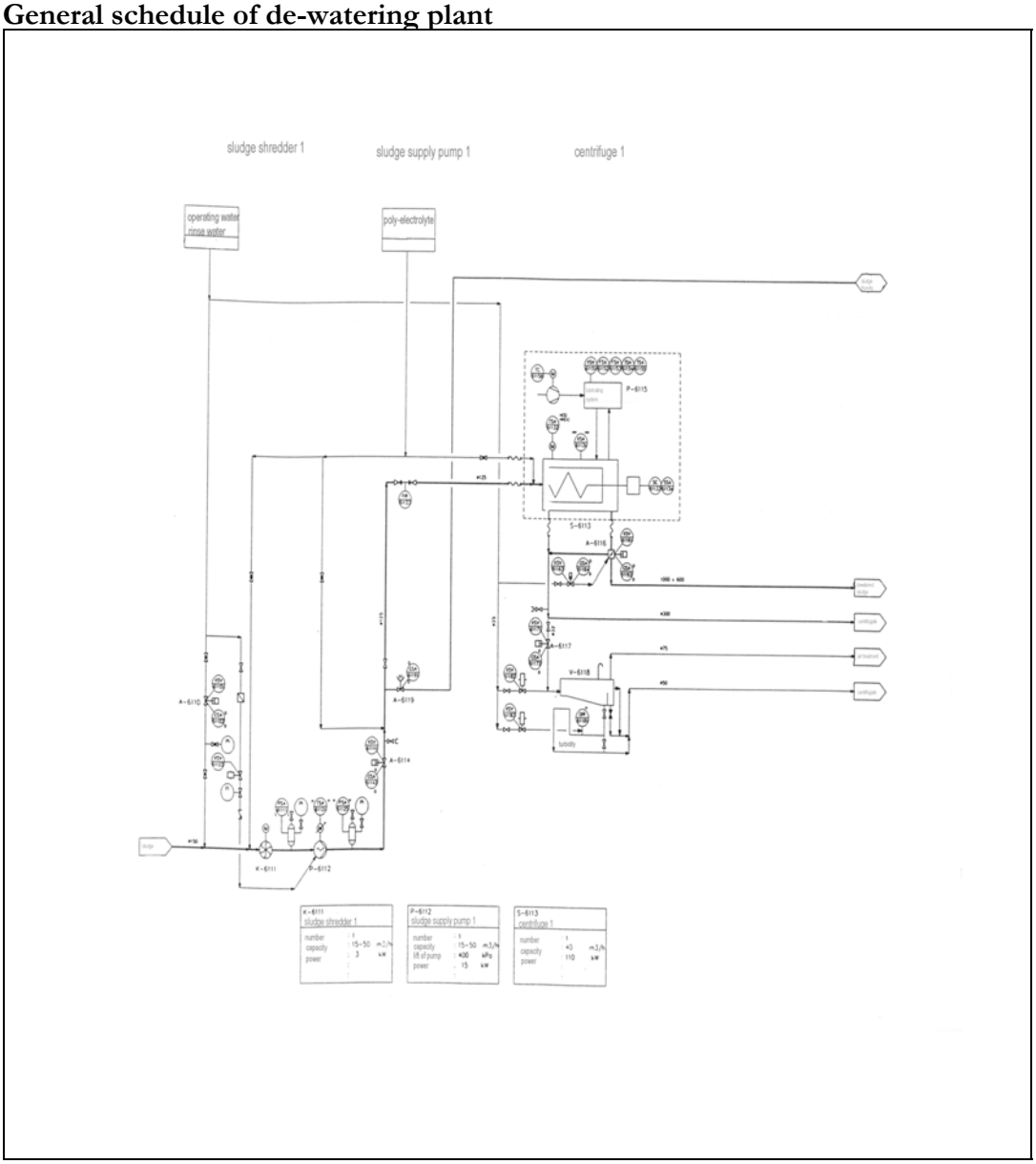
The reason both centrifuges were kept clean in the above test is because the centrate (liquid discharge from centrifuge) is recycled creating a closed loop. So in effect by treating one centrifuge, all centrifuges were treated.

See for last inspection, photo's 9,10,11 and 12 token by Ramon Ahmad, Marketing and Sales Director of B & D Ingenieursburo, The Netherlands.

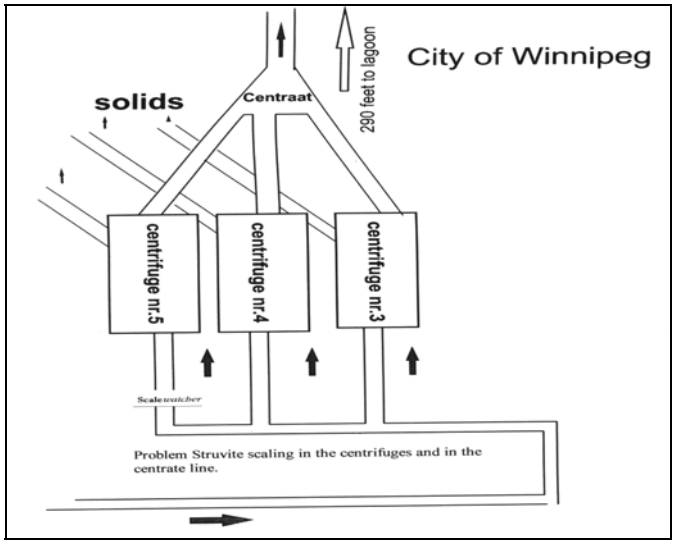
5. Conclusion

Thanks to the application of a **Scale***watcher* ® Industrial unit, the continuity of the wastewater treatment process with regard to the struvite deposit has been guaranteed and the maintenance costs have been reduced dramatically. Until today the centrifuge has not needed to be opened and cleaned due to struvite deposit.

General schedule of de-watering plant



General schedule of the sludge flow in Winnipeg sewage plant



Analysis of water

Parameter	Bulk	Dissolved minerals
Temperature	36.5°	
pH	7.6	
Conductivity	7617 µS/cm	
Alkalinity		3980 mg/l
Calcium		82.0 mg/l
Magnesium		47.3 mg/l
Ammonia	956 mg/l	
Phosphates	589 mg/l	26 mg/l
TDS	2.5%	

Sludge De-watering Appendix

Description

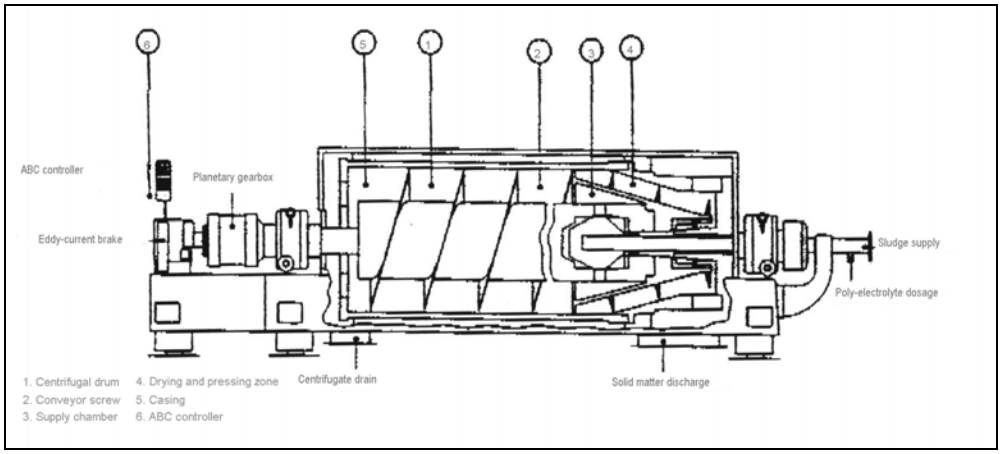
The fermented and thickened sludge from the thickeners is de-watered by a centrifuge installation. This installation consists of a sludge shredder, a sludge supply pump, a centrifuge, a sludge drain pump and a PE supply pump. The function of a sludge shredder is to keep the risk of blockage in the centrifuges to a minimum.

The shredded sludge is pumped to the centrifuges by four frequency-adjusted positive-displacement pumps (15-50 m^3/h). To promote the de-water ability of the sludge, fluid polyelectrolyte is added which creates a firm sludge flake which can well withstand the high mechanical forces which are normally found in the centrifuge. The capacity of the centrifuge is based on the dry matter load of 1680 kg dm/h and a sludge content of 4.5 to 5.4%. The separation return on the basis of the dry matter is approximately 97-98%. In the centrifuge, mechanical forces reduce the sludge's volume. As a result, the costs of removing the sludge to the place where it is further processed (incinerated) are considerably reduced.

The water in the sludge can, in order of complexity of de-watering, be divided into four groups:

1. Free water between the sludge particles.
2. Colloidal latent water.
3. Capillary latent water (in capillary channels between the particles).
4. Cellular latent water.

By using the centrifuges, the water in groups 1 and 2 and to a lesser degree group 3 can be removed.



The diagram shows a schematic cross-section of a centrifuge. The sludge is transported to the supply chamber (3) through the sludge supply pipe. As the centrifugal drum (1) is rotating at high speed, strong forces are generated so that the sludge, which is heavier than water, is forced outwards against the drum wall. As the conveyor screw (2) has a rotational speed, which is slightly slower than that of the drum, the sludge is transported to the drying and pressing zone (4). The drum tapers conically, so that the sludge is compressed and squeezed out. The de-watered sludge then leaves the centrifuge via the solid matter discharge. The water (centrate) flows away through the centrate drain via overflow plates. The de-watered sludge is transported to sludge silos by sludge drain pumps and temporarily stored there.

The centrate of the centrifuges is transported to the centrate underground tanks with a natural head. From the centrate tank the water flows with a natural head to the wastewater underground tank. From the wastewater tank the centrate, together with the other wastewater, is pumped to the water distributor.

During the sludge fermentation process, the microorganisms are damaged. As a result, CZV and Kjeldahl nitrogen are released from the bacteria cell, which is removed with the centrate. As the separation return of the centrifuges is not 100%, small flakes of sludge (fines) will also be removed with the centrate.

The turbidity of the centrate is measured to check that the de-watering process is functioning properly. To minimise the disruptive effect of gas bubbles in the centrate on the turbidity measurement, the centrate is de-aerated beforehand in a storage or de-aeration basin.

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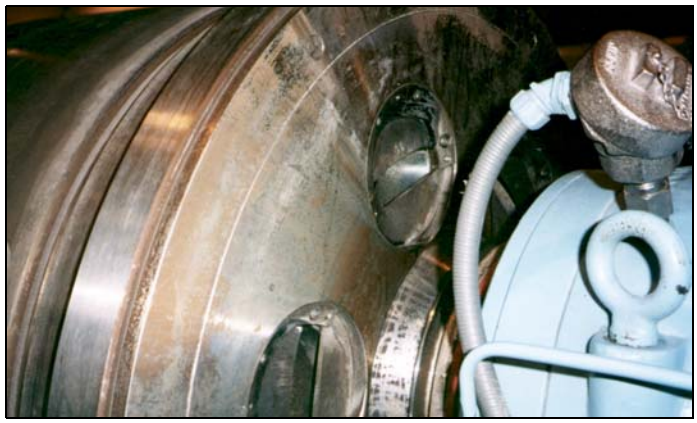
nr.2

nr.3

nr. 4



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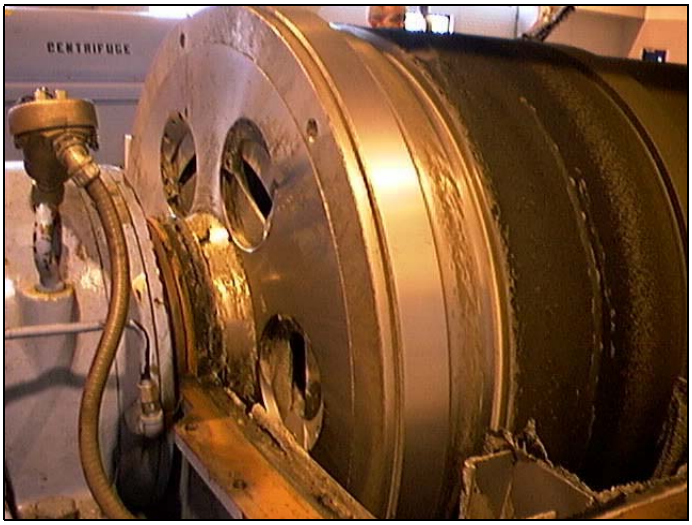

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