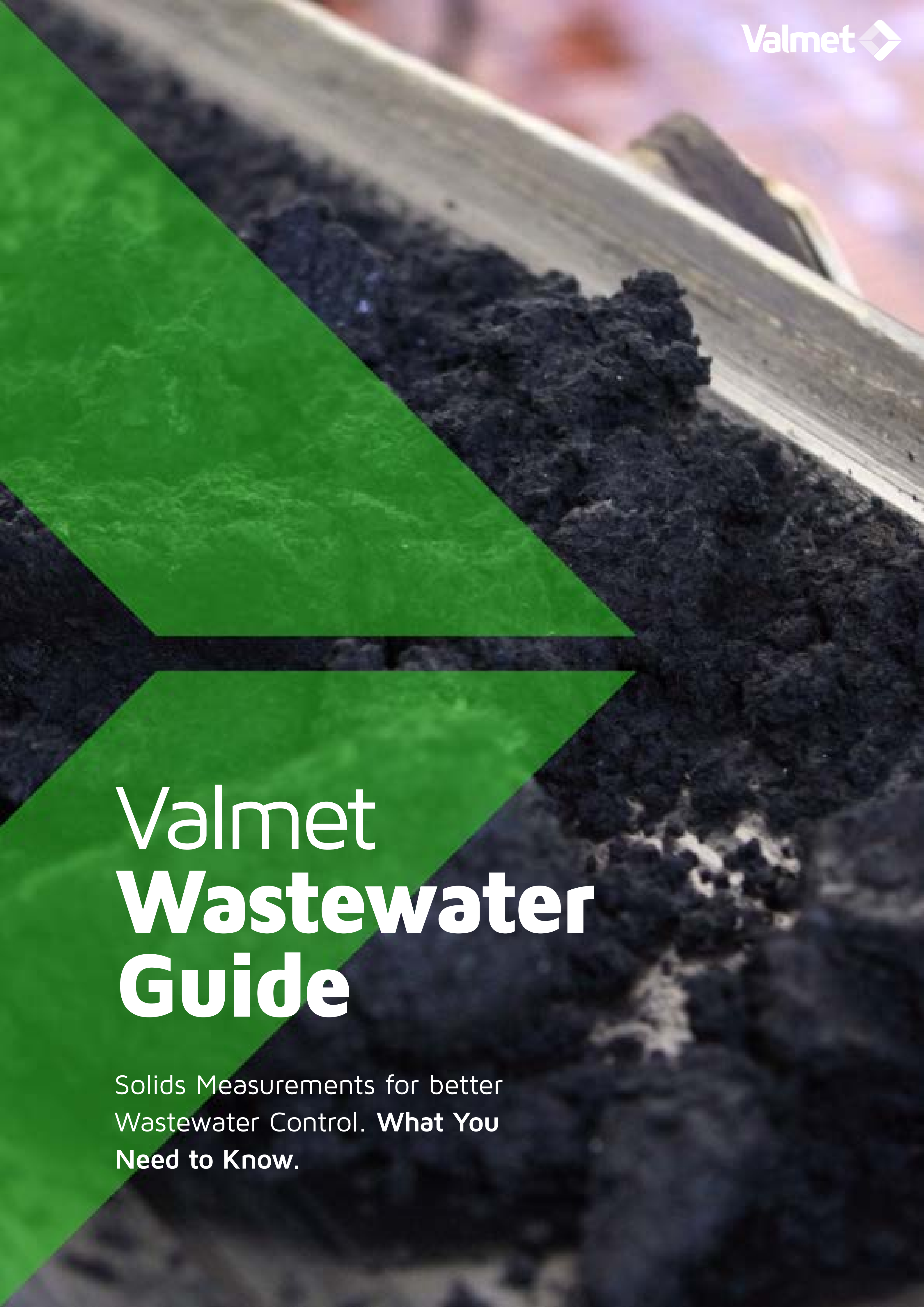


Valmet
Wastewater Guide

Solids Measurements for better Wastewater Control. **What You Need to Know.**

Valmet **Wastewater Guide**

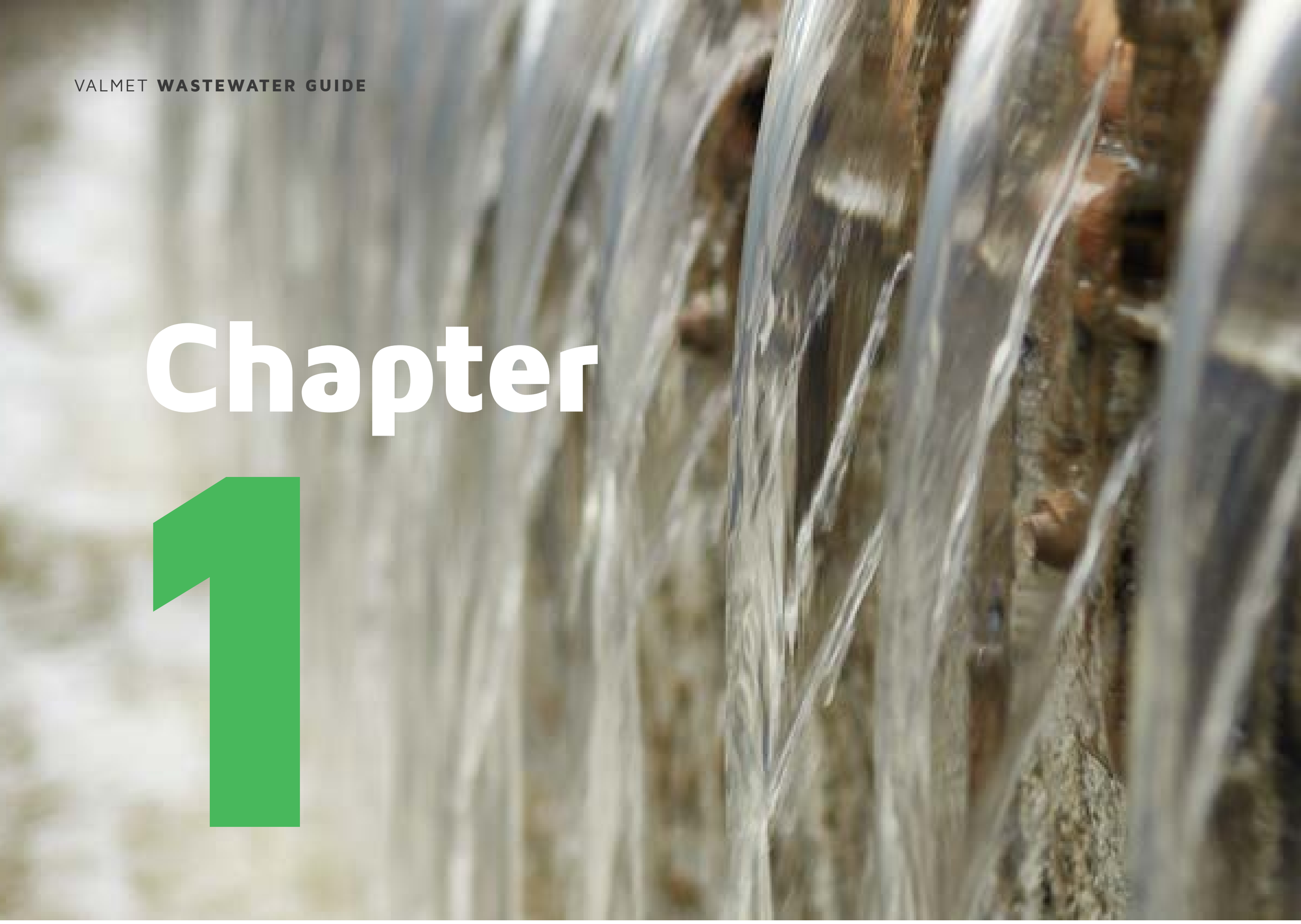
Why your facility should utilize
Online Solids Measurements
for better Wastewater Control.

Table of Contents

Introduction

Measurement of solids in wastewater treatment has always been a questionable proposition. Limitations in measurement accuracy along with long term reliability has been a concern to plant operators and engineers. Additionally, harsh and sometimes uncontrolled process conditions (e.g. fat, oil, and grease) offer additional challenges. Despite these challenges, dependable and accurate measurements are still being sought today in wastewater treatment. Why? The reward for having reliable solids measurements is great – instant and continuous solids measurement allows plant operations to optimize, automate, and improve their processes. This reduces plant operation costs through chemical and energy savings, while improving even further the environmental and public health benefits of wastewater treatment.

Before we begin discussing specific applications and available technology, let's begin with an overview of the basic terms, descriptions, calculations, and conversions that we encounter with wastewater treatment solids.



Chapter 1

Wastewater Solids – Definitions and Wastewater Solids Basics

Total Suspended Solids (TSS)

Total suspended solids are the solids matter that can be trapped by laboratory fiber filter. The filters are dried and weighed to calculate the TSS in mg/l. Calculated as dried solids weight/collected sample weight.

Total Dissolved Solids (TDS)

Total dissolved solids are the dissolved solids that pass through the fiber filter.

Volatile Suspended Solids (VSS)

The solids lost when a solid sample is ignited. This gives an approximation of the amount of organic compounds in the solids sample.

Fixed Solids (FS)

The residual after solids ignition. Considered "inert" and most likely not able to be broken down in digestion or available as a microorganism food source.

Total Solids (TS)

Total Suspended Solids (TSS) and Total Dissolved Solids (TDS) combined. Of course, TSS and TDS could be broken down further into VSS and FS as described above, but for simplicitie's sake we will define TS as seen below. Calculated as total dried solids weight/collected sample weight.

$$\mathbf{TS} = \mathrm{TSS} + \mathrm{TDS}$$

What units are used to quantify and measure the above – TS, mg/l, or ppm?

When working with wastewater solids it is good to define the units used to describe the solids. Typically, the values above are given in % solids, ppm, or mg/l.

%TS or %TSS = simply the amount of solids as described in the previous section, by percentage in a wastewater sample (TS or TSS = dried solids weight/weight sample collected depending on sampling method)

mg/l = weight in milligrams of solids per given volume of liquid sample

ppm = parts per million

NOTE

mg/l is equal to ppm. There are one million milligrams in a liter of water.

A conversion to keep in mind:

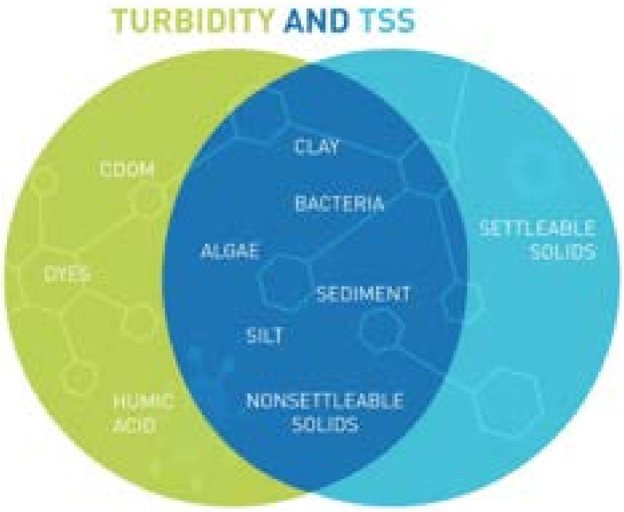
1% TS = 10,000 mg/l = 10,000 ppm
0.1% TS = 1,000 mg/l = 1,000 ppm
0.01% TS = 100mg/l = 100ppm

Turbidity vs Total Suspended Solids TSS%

A measurement that is used and sometimes confused with % TSS is Turbidity.

Turbidity is a measure of the cloudiness or clarity of the water sample and TSS is a measure by weight of the solids per volume of water sample. Turbidity is typically measured by transmitting an optical signal through the sample and measuring the amount of light scattered by the suspended particles. It is a primary measurement for water quality – especially on final effluent and drinking water. The unit of measure for Turbidity is NTU (Nephelometric Turbidity Units). It is important to note that the amount of light that reflects depends on the properties of the particles such as shape, color, flow rate, dispersion, and reflectivity. This makes correlation between TSS and Turbidity inconsistent between differing locations and applications.

Small fine particles can reflect light and be measured as turbidity, but may not contribute significantly to suspended solids. As we discuss measurement technology in a future chapter, keep in mind how this could produce challenges in calibrating optical TSS Measurements.



Source: https://www.westlab.com.au/blog/2015/04/29/what-is-the-difference-between-turbidity-and-tss

Mass Flow

Many processes require knowing mass flows or dry weight of the solids in a flow stream. For example, calculating mass flows in a flow stream to a centrifuge is very helpful in knowing the amount of polymer to inject into the feed flow.

Mass Flow = Flow units x Weight of unit x % Solids

For example, we are feeding a centrifuge as the following (US Customary Units):

Flow = 200 gpm
Solids = 1.75% TSS
Weight of one gallon water = 8.34 lbs.

Mass Flow = 200 gpm x 8.34 lbs/gallon water x .0175 (converting % to decimal) = 29.19 lbs/minute

SI/Metric Unit Examples:

Flow = 800 liters/minute
Solids = 1.75%
Weight per liter of water = 1kg or 1000 grams

Mass Flow = 800 lpm x 1kg x .0175 (converting % to decimal) = 14kg/minute

Or in m^3/s:

Mass Flow = .0133 m^3/s x 1000kg/m^3 x .0175 (converting % to decimal) = 0.23275 kg/second

Flow Velocity

Calculating Flow Velocity in a pipe is helpful in many cases. It can be estimated as follows:

US Customary Units:

Velocity (ft/s) = Flow (gpm) x .408 / pipe diameter^2

SI/Metric Units:

Velocity (m/s) = 1.273 x Flow(m3/s)/pipe diameter (m)^2

Chapter 2

Benefits of Solids Measurements

As we mentioned in Chapter 1, when you can accurately and reliably measure wastewater solids it allows for process optimization, automation, and cost savings.

Optimization Examples

For example, if you could measure the dry cake solids leaving a centrifuge in real time – the operator could optimize the centrifuge performance (torque) to produce the driest cake possible with the minimal amount of polymer usage. Since cake transportation is a high percentage of dewatering costs, as much as 50% or greater, producing the driest cake possible results in considerable savings.

Another example of process optimization is Solids Measurement in post Thickening to Thermophilic Anaerobic Digester Feed. Sending the highest amount of solids to your digester allows a higher Retention Time (SRT), higher Biogas production per gallon of solids pumped, and energy savings since solids are being heated in lieu of water.

Anaerobic Digester

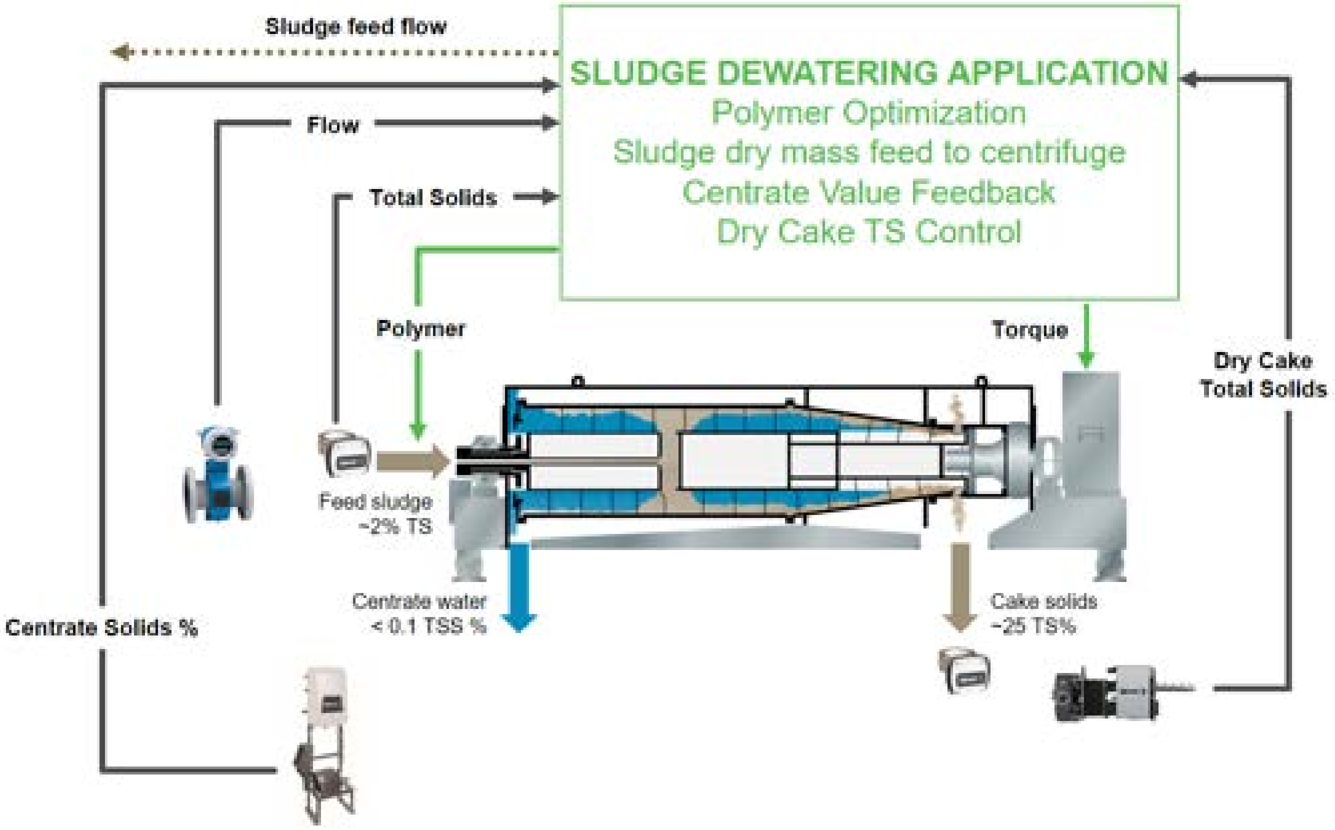
Cost Savings

A simple way to reduce polymer consumption is to measure the solids combined with flow feeding the centrifuge or other dewatering device, calculate the mass flow (dry solids per given time), and dose polymer based on mass flow. This feed-forward mass flow control strategy is a simple way to dose polymer on the exact amount of dry solids feeding the centrifuge. Very often, when implementing feed-forward polymer control over manual polymer dosing, a reduction of 15% or more of polymer can be realized. In some cases, a 25% and greater reduction in polymer has been seen.

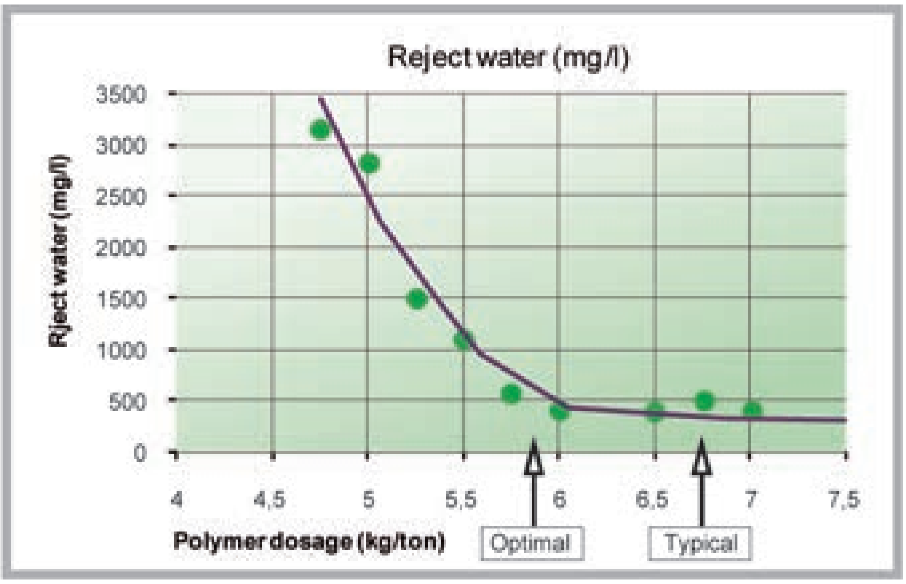
Another cost savings that can be realized is energy savings through pumping optimization. When solids are measured from a primary clarifier, manual or automatic controls can be in place that only allow pumping to the next process step (typically thickening) at a certain minimum solids amount or greater. This pumping optimization strategy reduces pumping time, lowers hydraulic and solids loading to further downstream processes, and by keeping the primary clarifiers balanced, it reduces the required maintenance.

Automation

Accurate and reliable solids measurements can allow for full automation. In the example below, three critical solids measurements are supplied for a centrifuge. As previously discussed, feed forward solids measurement is used for coarse polymer control, and Cake Solids is used for final product quality and torque control on the centrifuge. TSS Centrate measurement can be used for further polymer reduction – it allows the polymer to be optimized by reaching the critical knee-point where additional polymer does not optimize the TSS centrate quality.



Polymer dosage (kg/t)	Centrate water (mg/l)
4.75	3120
5.00	2800
5.25	1480
5.5	1080
5.75	540
6.00	400
6.5	380
6.75	460
7.00	380



Centrate (Reject) Water vs Polymer Dosing – Finding the "knee-point"

Each input is going to affect the centrifuge differently. As the centrifuge torque is increased, both centrate TSS and cake solids increase. Increasing polymer will increase cake solids yet decrease centrate TSS. The dynamic relationship between these control interactions cannot be controlled by standard PID controls.

However, higher level Model Predictive Control Strategy can help automate and control the centrifuge to optimize its operation, reduce polymer, and produce the driest cake possible. The point is, if repeatable solids measurements are utilized, some processes in waste water treatment can be not only optimized, but fully automated!

Challenges

Since solids measurements offer so many benefits in wastewater treatment, the question is why are solids measurements and controls not implemented in all wastewater treatment plants. Historically, past solids measurements in wastewater streams led to disappointimg results. Past measurements, mostly optical, were sensitive to color, drift, and affected by grease and fouling. Additionally, the technology required frequent calibration adjustments, and some even regular seal and other mechanical spares replacement.

Since measurement accuracy and reliability results have been disappointing, many wastewater operators and engineers lost faith and simply quit looking for solids and control solutions for wastewater processes.

In the next chapter, various solids measurement technologies will be discussed in regard to types, benefits, limitations, and application specificity.

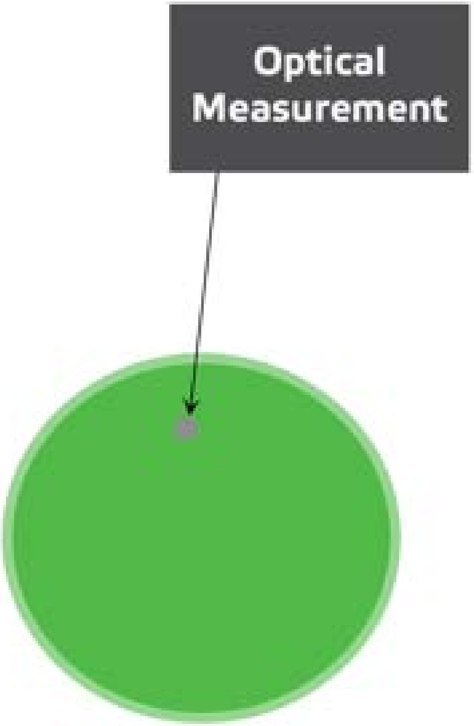
Chapter 3

The Technology

Like in most process industries, measurement technology should be applied based on specific application requirements and conditions. This applies to wastewater solids measurements. Each application should be reviewed before specifying a certain solids measurement type. This means that location, solids type and range, and accuracy demands should be considered before recommending a specific type of measurement.

Optical TSS Measurements

The most popular technology used in wastewater solids measurements is an inserted optical TSS measurement utilizing back scatter technology. Typically, these measurements are inexpensive and can be removed during active process flow. Optical measurements can be favored in lower solids applications, like WAS/RAS applications where FOG and debris are typically not found. Accuracy can be acceptable (+/-15% from lab), with good sampling and good follow-up monitoring and periodic checks/adjustments. This accuracy statement differs from many optical suppliers published specifications. This is due to many challenges that a typical inserted back-scatter optical measurement encounters in a wastewater process.



Measurement Size

A typical back-scatter optical TSS sensor measures a very small proportion of the overall sample in a process pipe missing the overall cross-section of total solids flow. The sensor is limited to just millimeters of sample flow producing a measurement that is not representative of the total sample flow.

Application Hazards and Limitations

Back Scatter Optical Technology, by its very nature, can be sensitive to color and change in solids type and quality. One way to test this is calibrate a single source optical sensor in clean water and then insert the measurement in a darker sample with no suspended solids. Typically, the measurement will shift when seeing a color change – although seeing no change in suspended solids. Additionally, optical technology is limited to lower solids range due to back scatter limitations in higher solids applications.

Another hazard is FOG or debris build-up on the measurement lens, where even a small film or haze can affect the accuracy and cause measurement drift. Some opticals attempt to combat this with wipers and other cleaning methods, but pulling the unit and physically cleaning seems to be the best way of removing the build-up. This is time consuming and limits the measurements ability to be used in control strategies.

Maintenance

In addition to periodic cleaning and offset adjustments some insertion opticals require regular maintenance like seal change, wiper change, and periodic calibration checks. This increases the overall cost of ownership and can reduce overall dependability and performance.

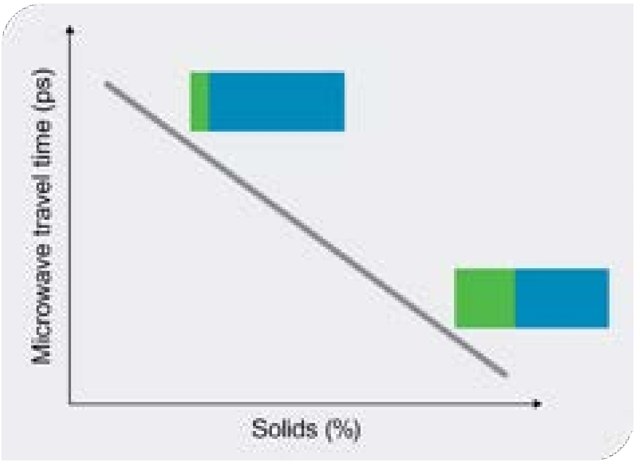
NOTE

Multi Source, Auto-Reference self-flushing Optical Centrate Measurement is available. There is a multi-source optical measurement that offers multi-source calibration, self-flushing with dearation control that provides the only optical measurement designed for wastewater centrate measurement. The multi-source calibration, deaeration control, along with self cleaning capabilities eliminates most of the application hazards mentioned above for opticals. There is also self diagnostic capabilities to indicate that measurement cell is cleaning. This technology has been used for years optimizing low solids applications in various process industries including wastewater centrate measurement.

Microwave Solids Measurement Technology

Microwave solids measurement is based on microwave time of flight technology. In simply terms, the microwave signal travels through solids faster than water – therefore correlating solids with the speed of the microwave signal. Since the measurement is not dependent on a physical property of the sample, like optical back-scatter, microwave technology measures independent of solids type (e.g. Primary, WAS), not limited in solids range, and can continue to measure with a certain amount of build-up on the sensor's lens. Microwaves extended range capability allows it to be used in almost all applications from Primary Clarifiers to Pumped Cake Measurements. Microwaves accuracy and insensitivity to color and other properties allows accuracy to reach within +/- 5% from lab with good sampling procedures.

Additionally, microwave sensors are positioned so a complete cross section of the solids stream is being continually measured – therefore guaranteeing representativeness of measurement.



Application Challenges

Excessive FOG build-up on the sensors can affect accuracy and cause the measurement to drift high – although glass lining has been able to either eliminate or reduce the effect of FOG build-up and has become an industry standard in microwave wastewater measurements. Additionally, microwave technology requires a full pipe, pressurized, and process flowing for an accurate measurement.

Maintenance

Since the technology has no moving parts, Microwave Solids Measurements come as close as possible to zero maintenance. Microwave technology, being an industrial grade measurement, has an expected 10-15 years life expectancy with no scheduled maintenance other than occasional lab checks.

NOTE

There is a new Cake Solids Analyzer technology available based on Microwave Resonance that can measure cake dropped through a chute or onto an auger. It augers the dropped cake sample into the measurement channel where it is measured by microwave resonance, later exiting back into the process via a bottom auger. This technology is gaining wide acceptance as the only solution for "dropped-cake" measurement.

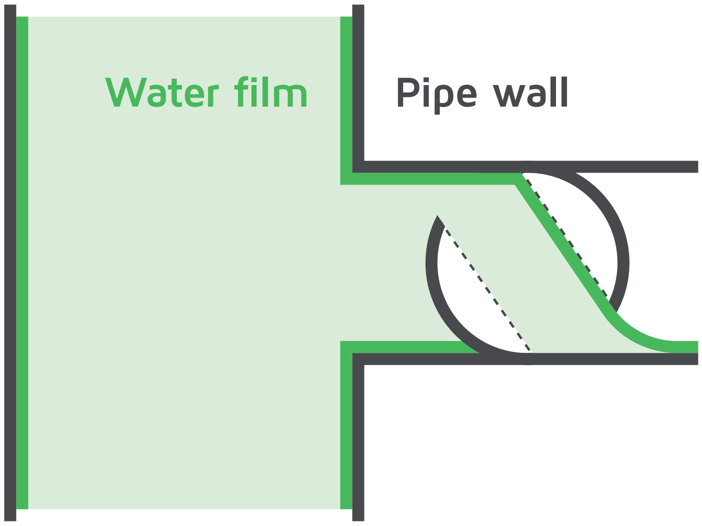

Valmet
Pro

Sample Valve

The solids measurement is verified by lab samples and it is important that the sample is taken correctly.

It is very typical to use a ball valve as sample valve. Sampling with ball valves has many challenges:

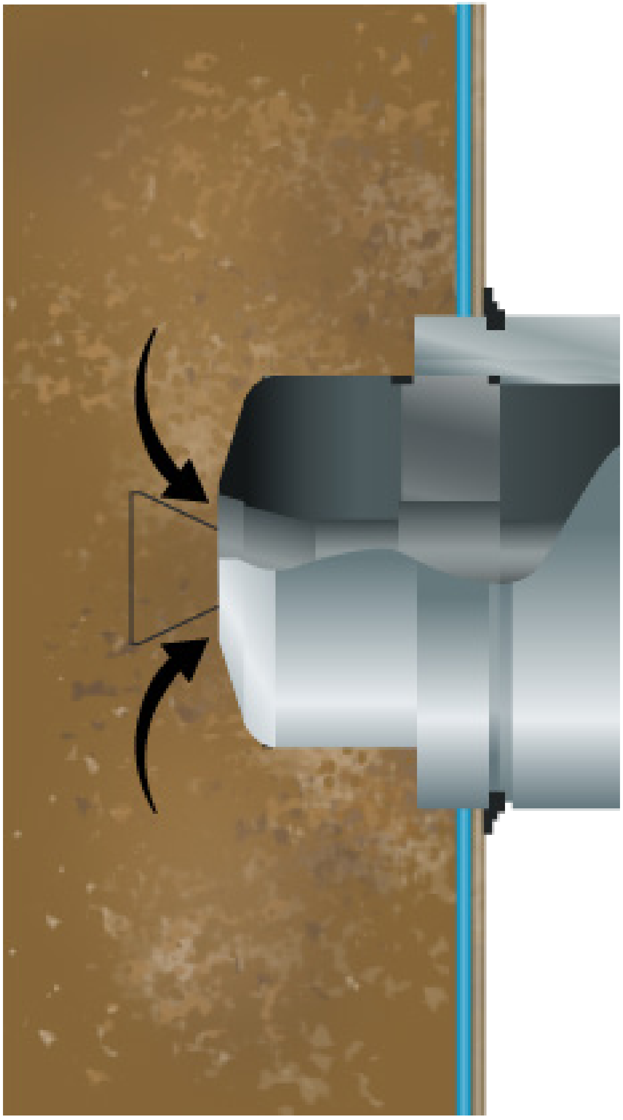
- Takes the sample at the pipe wall collecting water film
- Influenced by operator preference (amount of opening)
- High pressure gives large volume and uncontrolled flow
- Plugging risk



A more advanced sample valve technology is availabe which gives both safety and accuracy. Samplers based on an innovative piston insert design allows the pressure drop to occurr inside the pipe at the valve orifice.
This allows a smooth, non-splattering, and safe flow out of the sample valve's discharge for safe and accurate sample collection.

Representative and Repeatable Sample Collection

Piston Insert sample valves are designed to improve the accuracy of drawn process samples for more precise instrument calibration, improved process monitoring, and reliable reporting purposes. This superior performance is inherent in the valve's design. The two positions (closed or 100% open) design feature of the Piston sample valve delivers repeatable process samples independent of the sample collector.



- **Sampling inside water film**
- **Fully open**
- **Operator independent**
- **Adjustable flow**
- **Flushing water**

There are two options of Piston Style Safe Sampler available:

- Manual or pneumatic
- ScreenedPost Primary Clarifier Applications
- 0–8% Cs

- Pneumatic
- Used where the possibility of debris exists
- Cutting piston for Primary Sedimentation
- 0–16% Cs

Laboratory Testing

Lab Solids Testing, whether TSS or TS, is the standard to which the above measurements are compared to. Therefore, laboratory testing needs to be repeatable with a consistent time-tested procedure.

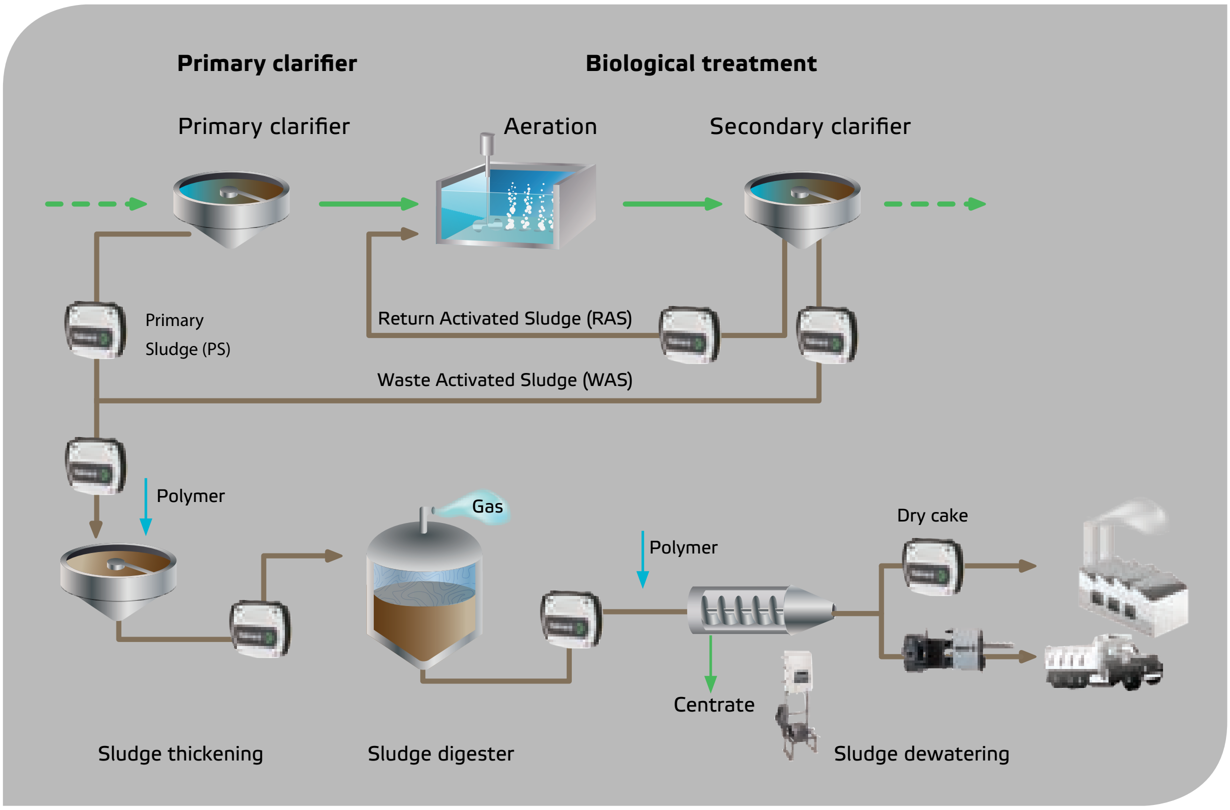
Many wastewater facilities utilize some form of the Standard Method 2540 for Total Solids (TS) and/or Total Suspended Solids (TSS). There are many variables that can affect laboratory repeatability, and a discussion of each would be beyond the scope of this guide. It would be an important step to compare your current laboratory procedure with the 2540 or other local Standard Method. Modifications to the Standard Method 2540 may be justified in some limited cases (e.g. solids sample is not homogenous, taking samples in triplicate to reduce uncertainty). Additionally, having trained staff that uses a repeatable and consistent procedure is important.

In conclusion, a word of caution when using a "quick" desktop solids measurement. Experience has seen results vary upon desktop manufacturers, power settings, and keeping the desktop servicing up to date. It is agreed that while the results are quick, nothing replaces actual laboratory sampling.

Chapter 4

Solids Measurements in the Wastewater Treatment Plant

Applying the appropriate technology discussed in Chapter 3 is the key to improving wastewater processes. The process diagram gives a look into a typical wastewater plant and the recommended Solids Measurements' locations that will allow application and plant optimization.



Primary Clarifiers

The goal of primary sedimentation is to allow the settleable solids to settle to the bottom, floatable materials (e.g. FOG, SCUM) to be skimmed from the top, reduce initial BOD, and allow suspended solids only to flow to the aeration process.

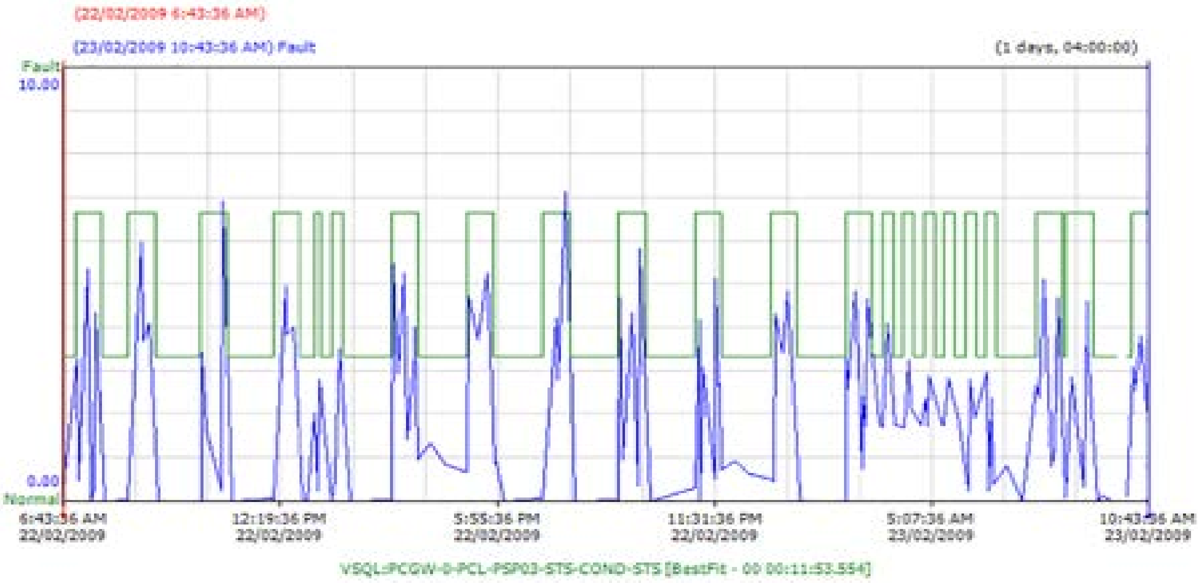
Optimizing this process involves locating a solids measurement on the outlet of the primary clarifier pump(s) and pumping the settleable solids based on solids content. You continue to pump the settleable solids from the bottom of the clarifier until a site specific minimum value is reached. The below trend shows the advantages of primary pumping optimization. The green line represents the primary pumping and the blue line represents solids %. The primary clarifier pump runs as long as the solids % is above a solids setpoint. Once the setpoint is reached the pump turns off.

Process Advantages:

- Pump higher solids and less water to Thickening and further solids treatment processes
- Energy savings through reduced pumping time
- Opportunity to automate the process utilizing VFD or simple on/off pump controls

Measurement Recommendations:

- Non-Intrusive Microwave based with glass lined internals to reduce build-up



Secondary Clarifiers (Activated Solids Process)

The main target of the activated sludge process is to remove BOD by adding air to primary effluent, allowing “bugs” to digest the solids, and then either pump the “bugs” back into the aeration process (RAS) or into further solids thickening or dewatering processes (WAS).

Efficiently removing WAS from the Secondary Clarifiers is called Wasting. Wasting can be accomplished through a few different means but the most common is called SRT (Solids Retention Time). SRT is the average age of the bugs in the Activated Sludge Process that is determined to maintain a “healthy” population and optimize digestion efficiency. SRT is set by plant operations through both laboratory observation of “bug” health and experience. Bug average age (SRT) can be calculated by dry weight of the bugs in aeration (aeration + secondary clarifiers)/dry weight of bugs leaving the system (Wasted).

SRT (bugs age in days) = pounds of bugs in aeration/pounds bugs leaving aeration system

Having reliable solids measurements on Post Aeration and Secondary Clarifier Outlet along with flow indication, allows SRT Wasting to be accomplished on a mass flow (dry weight) basis in lieu of being based on flow and estimating solids based on a past laboratory sample.

Process Advantages:

- Knowing in real time the amount of solids to determine accurate Wasting Amounts (WAS) in solids not flow – Automating the WASTING process

Measurement Recommendations:

- Non-Intrusive Microwave Based for long life and reduced maintenance on WAS/RAS line with Optical as a second choice
- Optical – typically inserted into basin to MLSS (Mixed Liquor) leaving aeration into Secondary Clarifiers (may require periodic maintenance and calibration checks)

Thickening

The goal of the Thickening process is to reduce volume by removing excess water from the process flow. Thickening is accomplished by many means like Gravity Thickeners, Gravity Belt Thickeners, Thickening Centrifuges, and Dissolved Air Flotation. Whatever the technology, typically polymer is added to produce the flocculation of the solids. Feed Forward Solids Measurements allow for a correct mass flow (dry weight) of solids being pumped to the Thickening Process, which in turn allows an accurate polymer amount to be dosed.

Process Advantages:

- Feed Forward Solids Measurement allows accurate polymer dosing

Measurement Recommendations:

- Non-Intrusive Microwave based with glass lined internals to reduce build-up and allow for a wide solids range

Anaerobic Digestion

The target of Anaerobic Digestion is to improve dewaterability of the solids, produce biogas, and reduce volume and organic matter by "digesting" biosolids under Mesophilic or Thermophilic conditions. In order to accomplish this task of objectives, a good real time measurement from post thickening to Digestion is imperative. The Measurement should be able to measure a wide range of solids as the goal is to get as thick as possible solids in the Digester. The reasoning is that it takes the same amount of energy to heat one gallon of process at 2.00% solids as it does one gallon of process at 4.00% solids. Therefore, the higher the solids, the less energy is used per ton of dry solids pumped into the digester. Additionally, the higher the solids in the digester, the higher the biosolids produced per gallon of solids pumped to the digester.

Process Advantages:

- Energy reduction or optimization
- Feedback on Thickener Performance
- Improved Biogas Production

Measurement Recommendations:

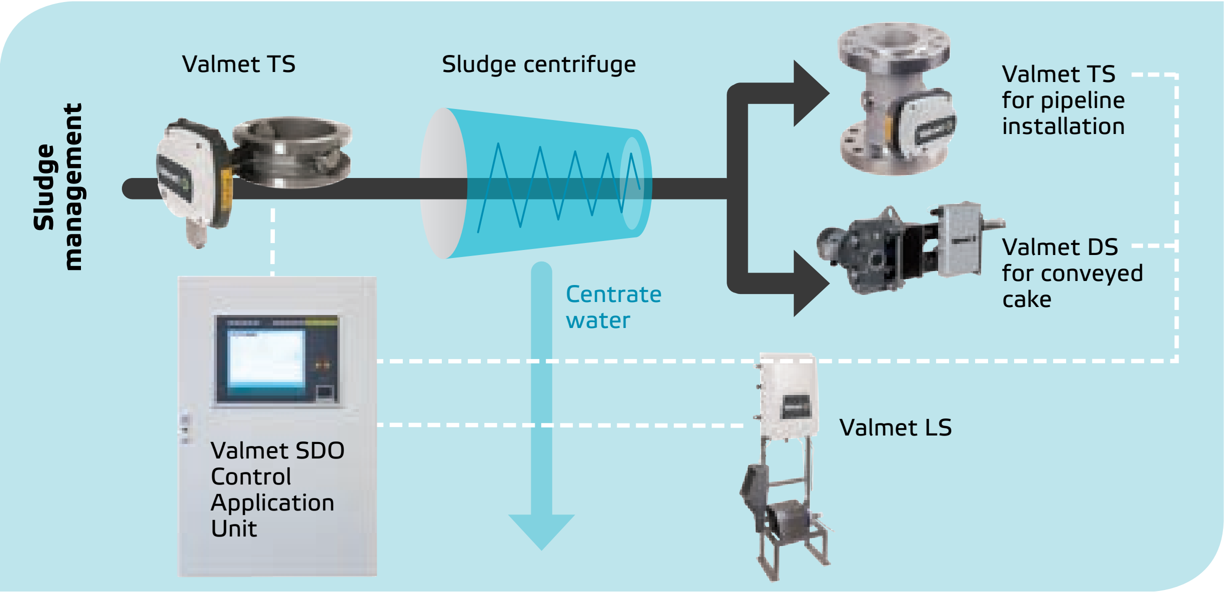
- Non-Intrusive Microwave based with glass lined internals due to potential higher solids feed and build-up potential

Dewatering

The Dewatering target is to produce the driest "cake" as final product with the lowest amount of polymer and energy as possible. Dewatering can be accomplished by many means, but the two most popular is the Dewatering Centrifuge and Belt Filter Presses.

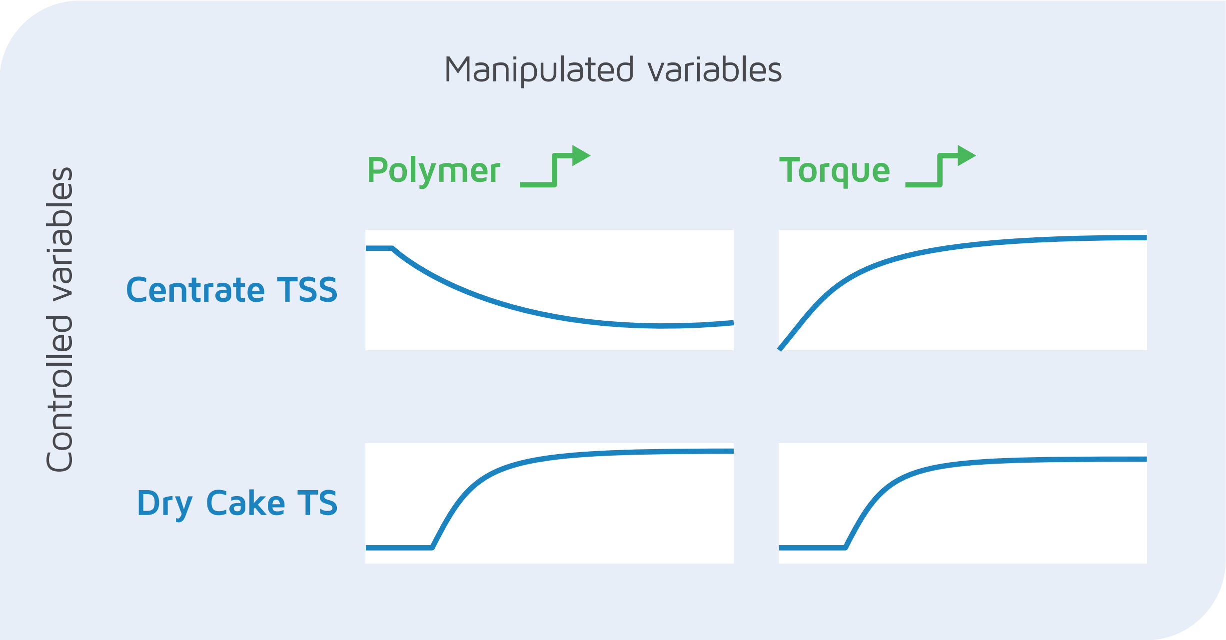
Three (3) solids measurement opportunities are available to optimize dewatering.

- The Feed Forward Solids Measurement is used to calculate mass flow to the centrifuge and dosing polymer on actual dry solids to the centrifuge.
- A Centrate Measurement with multi-source and self-cleaning auto reference allows for further polymer reduction and centrifuge Feedback Control.
- A final cake sensor (available for pumped or dropped cake) for final product measurement and centrifuge feedback.



Depending on requirements and goals, some facilities use one or two measurements while some prefer to utilize all three measurements.
Once three measurements are utilized, it is not a far step to fully optimize a dewatering centrifuge with a Model Predictive Control strategy. To further the point brought out in Chapter 2, when one variable is changed, like polymer, it affects both centrate and Dry Cake quality. In turn, when centrifuge torque is adjusted, both centrate and Dry Cake quality change. Additionally, as one control output affects many Process Variables, the reaction time and rate of each process variable is also dynamic.

Model Predictive Control takes into consideration all the input variables and output setpoints of polymer, centrifuge torque, and centrifuge feed flow to achieve the highest cake solids with lowest polymer dosing. This is an example of how reliable and accurate measurements allow for control implementation in lieu of just general indication.



Polymer and Torque Process Models to Centrate TSS and Dry Cake TS

Process Advantages:

- Polymer reduction
- Drier Cake amount reducing transit costs – some facilities have found just a modest increase in cake dryness can significantly reduce trucking costs. For example, one facility calculated for every 1% increase in Dry Cake their trucking costs decreased by $100 00 USD.

Measurement Recommendations:

- Non-Intrusive Microwave based Solids Measurement for Feed Forward (solids with optical insertion model being a second choice)
- Multi-source and self-cleaning auto-reference Centrate Measurement
- Microwave Based Cake Measurement for pumped or “dropped” cake

Lagoon Dredging

Some facilities use Lagoon Systems in their biosolids treatment program. The biomass settles to the bottom of the lagoon, and once a certain level is reached the lagoon biomass needs to be removed using of a lagoon dredge. Knowing the solids while pumping allows the inlet pipe depth to be adjusted for optimum depth and solids collection. An optimized amount of solids is pumped reducing pumping costs, time, and operation dredging efficiencies.

Conclusion: Tampere Case

A True Story of Mass Balance, Increased Capacity and Improved Dewatering

We decided to conclude this guide with a case story where a modest investment in measurements and basic controls alone increased plant capacity, automated dewatering, and allowed the plant to develop a Mass Balance Strategy. This story happened in the Finnish city of Tampere, that has over 200 000 people with daily flows averaging 70 000 m^3 (18MGD). The city was in need of more solids processing capacity as future expansion was not scheduled for another ten years.

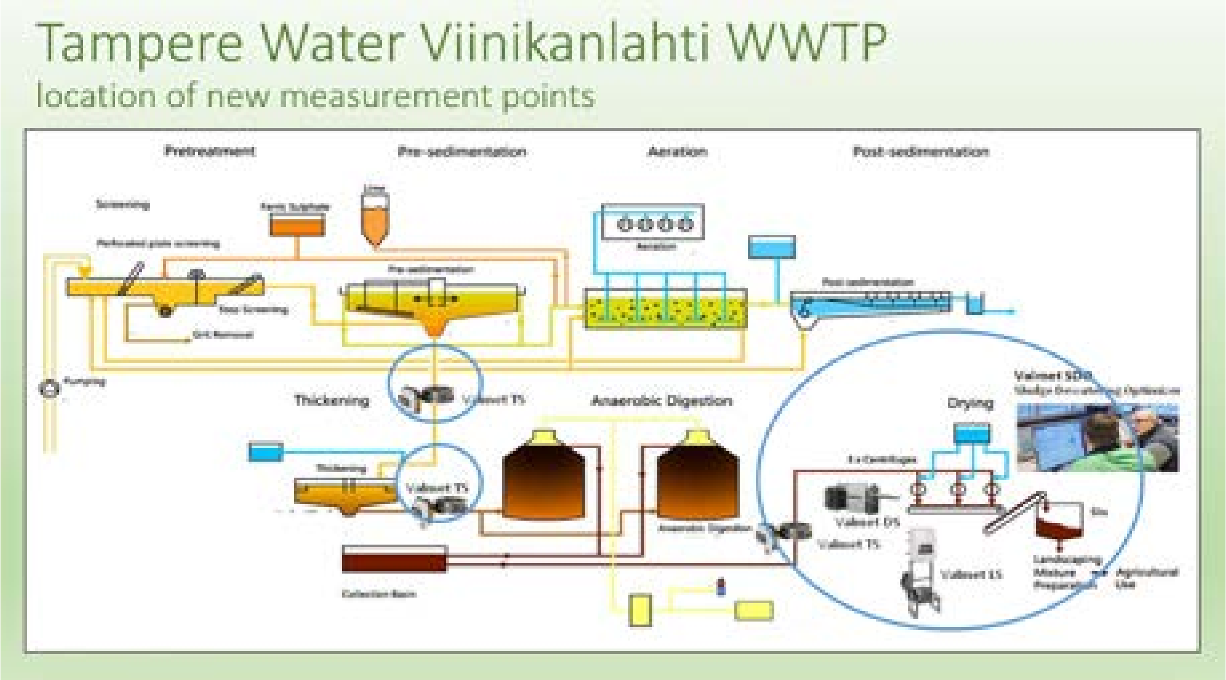
Project Targets

- Reduce flows from clarifiers from current average 76 m^3/hr by 20% while maintaining sludge mass.
- Increase solids in the digester from 3.5% to improve biogas production and minimize flow through to dewatering.
- Reduce polymer use in dewatering centrifuge by 20% from current 8 kg/ton.
- Reduce solids sampling frequency and lab work.
- Increase cake solids by 1-2% to reduce transportation costs, which can amount to over 60% of dewatering costs.
- Reduce centrate solids by 25% to minimize recirculation.
- Create sustainable savings for energy and chemical use.

Project Challenges

- Process areas are managed based on volumetric flows supported by daily sampling of solids. The sampling provides “moment in time” solids quality, which is not enough data to optimize and automate on a continuous basis.
- Solids pumping out of clarifiers is based on time duration supported by daily sludge blanket analysis.
- Solids feed to digester and centrifuge operation are also based on volumetric flows supported by daily sampling.
- Centrifuge centrate quality is challenging to measure with probes due to foaming and sensor lens contamination.
- Dry cake falling through chute – how to continuously measure solids content?
- Operators need to trust the new technology.
- Return on investment in less than one year.

Based on the above targets and challenges, it was determined to install solids measurements on the Primary Clarifier outlet, Post Thickening to Digester Feed, and three measurements on dewatering (centrate, cake, and solids feed). Additionally, Model Predictive Controls were implemented on the Centrifuge to automate centrifuge operation and optimize polymer and dry cake percentage.



Tampere Water Viinikanlahti WWTP

location of new measurement points

The test period lasted 90 days after calibration and controls implementation. After the 90 days test period the following KPIs were achieved (the green values are further improvements reached after the 90 days test period).

KPI	Previous	Achieved	Target	Result	Annual Saving USD
Clarifier outflow decrease	76 m^3/hr	50 m^3/hr **Now 43 m^3/hr**	20%	34%	$12 500
Feed solids to digester increase	3.5%	5% **Now 7-8%**	1.5%	1.5%	**Higher gas production** No numbers available now
Dewatering polymer decrease	8 kg/ton	5 kg/ton **Now 4 kg/ton**	20%	40%	$85 000
Centrate solids decrease	**2424 mg/l**	**1000 mg/l**	20%	50%	$18 000
Cake solids increase	29.7%	31% **Now 31.5-32%**	1-2%	1.3%	$100 000
Sampling frequency decrease	One/day	One/week **One/week**			$8 000
ROI			12 months	8 months	
Annual hard savings			$150 000		**$223 500**

As it can be seen, all targets were met with a ROI reached within 8 months. Increased plant capacity was achieved with no major infrastructure investments. All results are sustainable and repeatable with no further investment. Interesting to note that a significant amount of the savings, approximately 50%, came with the increase of cake dryness resulting in decreased cake transportation costs.

Additionally, the measurements allowed mass balance equilibrium to be reached throughout the plant within 120 days from the project start date. Operators also embraced operating the facility based on mass balance and relying on the newly implemented controls and measurements.

This is a great example of how solids measurements can be utilized in any wastewater facility to improve and even automate your processes.

Thank you for taking time to read our guide and please forward any questions and comments.

Contact us to discuss how we can help!

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