

# Municipal Industry Note

## **THE USE OF TRANSIT-TIME AND DOPPLER FLOWMETERS IN WASTEWATER TREATMENT PLANTS**

### **INTRODUCTION**

Due to increased regulations and the need for improved performance and efficiency, the wastewater industry's demand for flow measurement equipment will continue to grow. Transit-Time and Doppler flowmeters offer unique benefits that are ideal for this market and we can therefore expect a dramatic increase in their use. Unfortunately, there are many preconceptions and misconceptions about the use of ultrasonic flowmeters within a wastewater treatment plant. This Industry Note will provide a clear insight into the proper selection and use of the two types of ultrasonic flowmeters; transit-time and Doppler.

### **TRANSIT-TIME OR DOPPLER**

A common misconception is that if the flowmeter is ultrasonic then it must be a Doppler. Another common misconception among users who are aware of transit-time flowmeters is that this technology is only suitable for so called "clean" liquid applications. Our goal is to educate flowmeter users as to the existence and applicability of the transit-time technology and how it differs from the Doppler method.

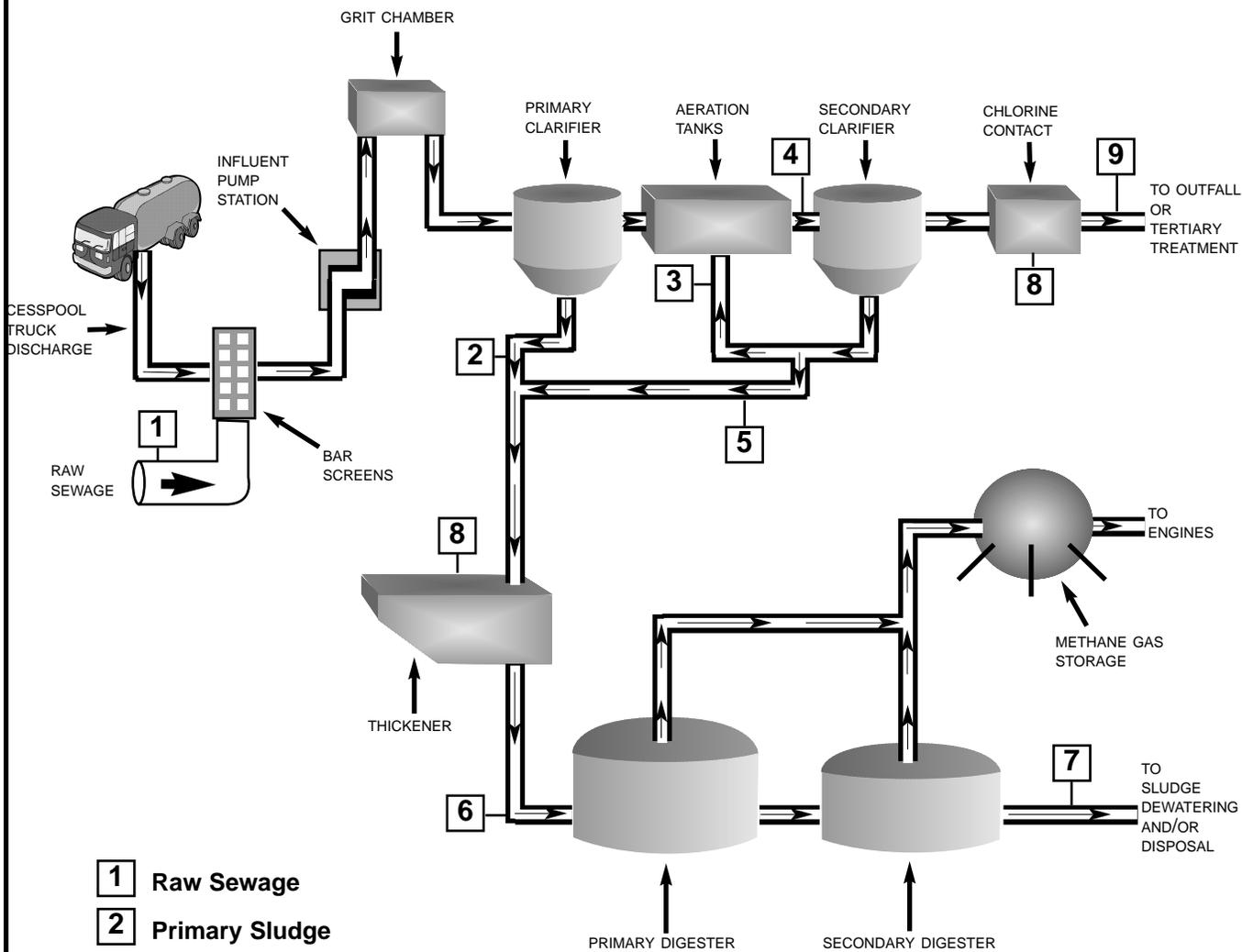
First, it is important to recognize that Controlotron's System 1010 easily handles applications that might be too difficult for our competitor's transit-time flowmeters. Its ability to handle significant levels of entrained gases or solids has established System 1010 as the state-of-the-art for all transit-time flowmeters.

In addition, System 1010 offers the unique advantage of being a Multifunction Flowmeter. System 1010 is the only flowmeter available offering both Transit-Time and Doppler flow measurement techniques in the same meter. As a result, System 1010 is the only flowmeter a wastewater treatment facility requires to measure all full pipe liquid applications.

There is a significant difference between Controlotron's System 1010 Reflexor and System 190 Spectra Flowmeter from conventional Doppler flowmeters. The Spectra and Reflexor use fast fourier transform spectral analysis. This digital filtering technique enhances these meter's accuracy and applicability beyond all competitive Doppler flowmeters.

Wastewater treatment plant applications vary in percent solids and entrained gases. The applicability of a particular flowmeter depends on the specific level of solids and/or gases present in the flowing liquid. In addition, there are many applications that suit either technology. The final meter selection would be decided by required performance and budgetary considerations. However, since System 1010 is a Multifunction Flowmeter, allowing the choice of either transit-time or Doppler, a user can select this meter without concern for the application.

## PRIMARY & SECONDARY SEWAGE TREATMENT



- 1** Raw Sewage
- 2** Primary Sludge
- 3** Return Activated Sludge
- 4** Mixed Liquor
- 5** Waste Activated Sludge
- 6** Thickened Sludge
- 7** Digested Sludge
- 8** Chemical Additives
- 9** Effluent

## **APPLICATIONS**

- 1 Raw Sewage** - Raw Sewage flow can be measured at many points within the wastewater system. Meters can be installed at locations such as lift stations, sewer lines (interceptors, force mains, etc.) or at the treatment plant's influent pump station. Raw sewage contains low amounts of suspended solids. Transit-Time Flowmeters are the ideal flowmeter for this application. Doppler Flowmeters can be used on this application if there is a sufficient level of aeration or suspended solids in the flow stream.
- 2 Primary Sludge** - Primary sludge is the settled solids stream removed from a primary clarifier. Suspended solids typically range from 0.5 to 3%. The sludge is pumped from the primary clarifier to a thickener for enhanced solids removal. Transit-Time and Doppler flowmeters are both suitable for this application. However, we recommend the Transit-Time because of its superior performance.
- 3 Return Activated Sludge** - Return Activated Sludge (RAS) is the settled solids stream removed from a secondary clarifier and returned to the inlet side of an aeration tank. The aeration tank's performance and efficiency depends on the proper feed rate and solids content of the return sludge. Suspended solids typically range from 1% to as much as 4% depending on the treatment process. Transit-Time is very successful on this application. Doppler also will work quite well. However, using Doppler will relinquish the performance advantage that the Transit-Time offers.
- 4 Mixed Liquor** - Mixed Liquor, also known as secondary influent, is the liquid stream discharged from the aeration tank to the secondary clarifier. This liquid can be very aerated under normal operating conditions. As a result, and under normal conditions, the Doppler meter is the proper selection for this application.
- 5 Waste Activated Sludge** - Waste Activated Sludge (WAS) is the same as return activated sludge, except that the waste sludge is pumped directly to a thickener for further processing. The solids content and flowmeter recommendation is the same as the return sludge.
- 6 Thickened Sludge** - Sludge thickening can be accomplished by mechanical means or with assistance from chemical additives. The incoming sludge is thickened to increase the percent solids. The percent solids can range from 6% to 10% or higher. We have been successful using Transit-Time on thickened sludge in the 6 to 8% range. However, the suitability of Transit-Time will be dependent on the type of thickening process and the ultimate solids content. Doppler will perform very well on this application and should definitely be selected if a demonstration of Transit-Time is unsuccessful.
- 7 Digested Sludge** - Sludge digestion reduces the potential harmful and toxic environmental effects after final disposal. It is not unusual to find digested sludge with a solids content of 6 to 8%. This sludge may be laden with high levels of entrained methane. Due to the System 1010's ability to handle applications with high levels of aeration, it may be suitable for this application. We have been successful in using the 1010 on digested sludge lines but we recommend that a demonstration should be performed on this application if possible. If the demonstration proves Transit-Time to be unsuitable then Doppler would be the meter of choice.
- 8 Chemical Additives** - The wastewater treatment process uses chemical additives for reasons such as coagulation, disinfection and pH adjustment. Some common chemical additives are polymers, sodium hypochlorite and sodium hydroxide. Transit-Time, specifically the FlowTube, is very well suited to measure these liquids and should be the selected meter. Use of Doppler for most chemical additive applications should be avoided.
- 9 Effluent** - Effluent from a wastewater treatment plant is low in suspended solids. This is also true of the liquid stream through a tertiary treatment process. These applications are ideal for Transit-Time. Unless there is a sufficient level of entrained air, plant effluent is too low in solids content for a Doppler meter.

## **OTHER FLOWMETER TECHNOLOGIES**

It should be noted that presently, magnetic flowmeters or venturi tubes are the prevalent flowmeters for the applications described in this Industry Note. The clamp-on non-intrusive nature of the transit-time and Doppler technologies offers many benefits over these intrusive meters. The following is a list of some of these benefits:

- Simple and inexpensive installation
- Lower equipment cost
- Minimal maintenance
- Unmatched rangeability
- No parts to wear or foul (especially electrodes, liners or seals)
- Ability to detect pipe wall build-up
- Ability to detect cavitation
- Internal datalogger and stripchart

## **CONCLUSION**

We recommend our System 1010 Transit-Time Flowmeter for most wastewater treatment plant applications. The Spectra System 190 and System 1010 Reflexor Flowmeters are the ideal choice for those applications not suited for Transit-Time. On the applications equally suited for both technologies, we recommend Transit-Time simply because of its superior performance.

Ultrasonic flow measurement avoids the application problems associated with conventional intrusive flowmeters. Controlotron's System 1010 and 190 Flowmeters offer unrivaled performance for their respective technologies. Combined, they offer cost-effective and highly accurate flow measurement for all the applications in a wastewater treatment plant.



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