

## Installation hints for radiometric density measurements in sewage plants

Radiometric density measurements are successfully used in sewage plants since a long time. As the measurement is done without mechanically moved parts and without contact with the product to be measured the system works extremely reliable. For reaching a high measuring accuracy and an operation free from interferences some points have to be considered when choosing the installation point and when installing.

The pipeline has to be filled completely during operation at the measuring point with the product to be measured. If the pipe is only partly filled measuring errors are occurring.

- a) Gas bubbles in the product lead to measuring errors. The gas density is zero compared with the sludge density. At a sludge density of  $1020 \text{ kg/m}^3$  and at a gas part of 10 vol. % there is a density of

$$\rho_s = 0,9 \cdot 1020 + 0,1 \cdot 0 = 0,918 \text{ kg / m}^3$$

$\rho_s$  = Suspension Density

- b) The influence can be reduced if the measurement is installed at a point of the pipeline with a possibly high pressure. (Installation in the pump pressure piping or at the low end of standpipes). An increasing of the pressure by decreasing the cross section of the pipeline proved also to be very worthwhile. A pressure of  $6 \text{ kp/cm}^2$  at the measuring point is recommended.

### Errors caused by gas bubbles

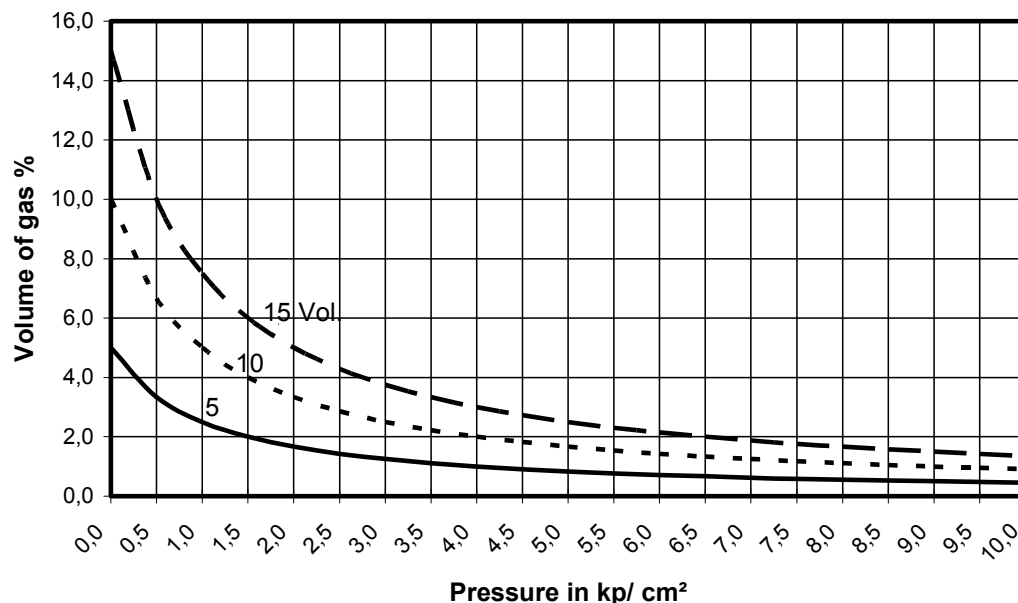
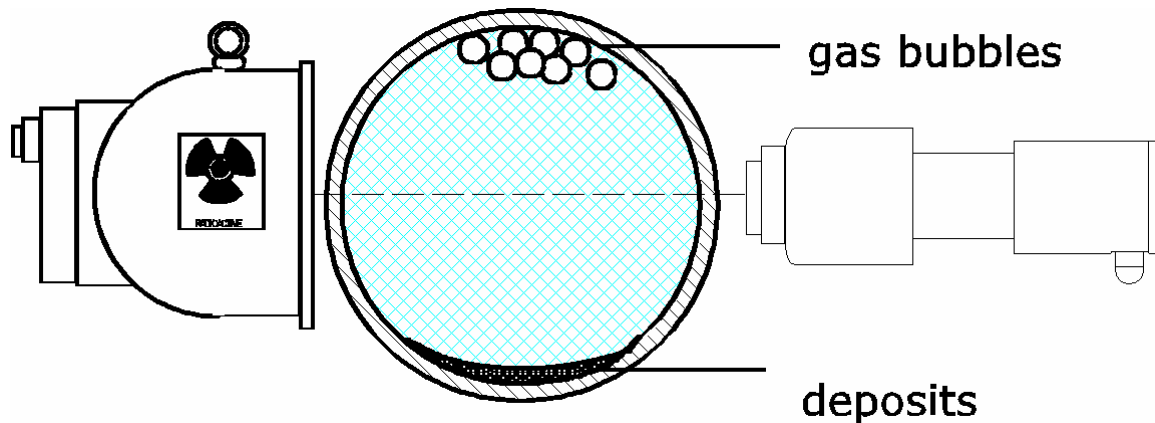


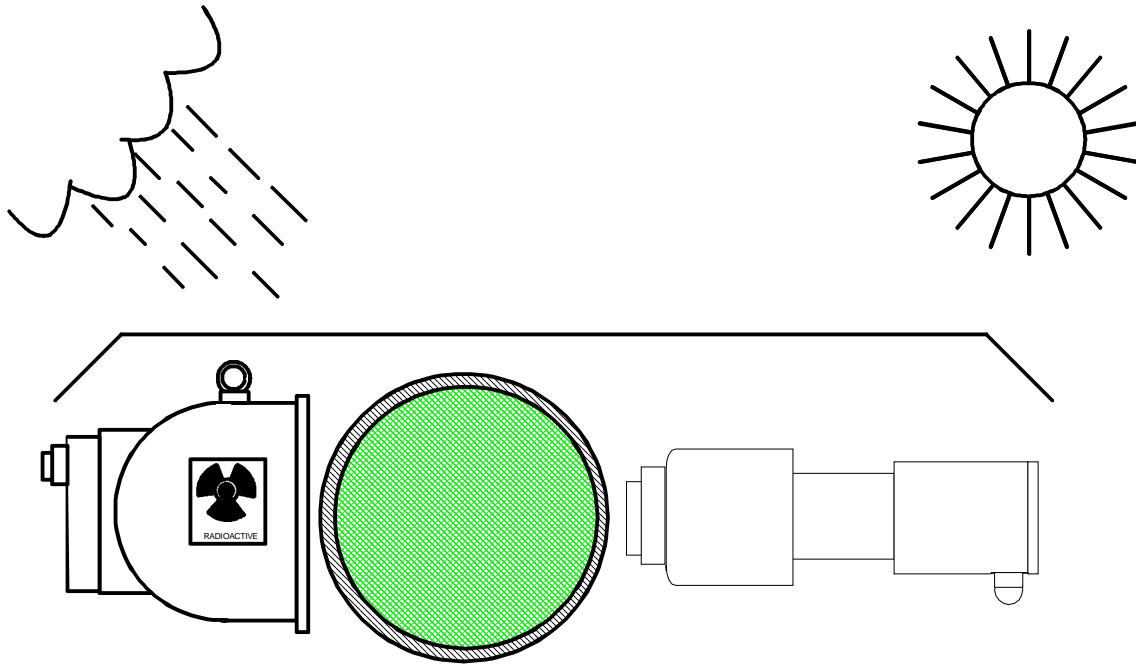
Fig. 1

- c) Measurements at horizontal conductions with horizontal irradiation. In this way errors by possible deposits can be avoided.



**Fig. 2: Installation at a horizontal conduction with air bubbles in the product and deposits**

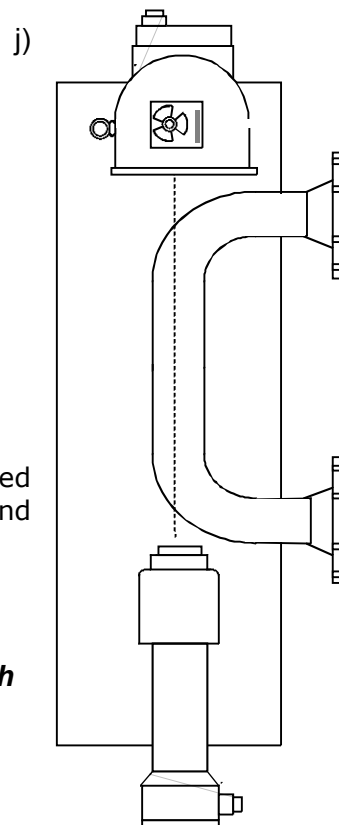
- d) Extensions of the pipeline should be avoided if possible. If these cannot be avoided, they should basically be performed only at vertical conductions.
- e) Extensions of the pipeline can be performed at the measuring point only if
- a continuous flow of the product over the whole cross section of the pipeline is guaranteed. This is not always guaranteed for products with high viscosity. Mainly there is a product flow only in the centre. By the measurement the product in the radiation path is intercepted over the whole diameter. The measuring result is then not representative.
  - no gas bubbles can get stuck in the radiation path.
- f) Regarding measurements at suspensions the measurement should not be performed directly after a pipe bend, as there is no homogeneous material arrangement.
- g) The distance to the bend must become higher
- when the flow speed becomes faster
  - when the difference between the density of liquid and the density of solids becomes bigger.
- h) Regarding open air installations the measuring system should be protected against rain and sun by a roof.



**Fig. 3 : Open Air Installation**

- i) A measuring path in S- or U-form has to be installed in a way that the shielding container is at the top and the detector at the bottom.

**Fig .4: Mounting of a S respectively U measuring path**



- j) For calibrating the measurement samples are necessary. Therefore near to the measuring point there should be a possibility for taking samples.
- k) A temperature compensation is recommended for measurements in sewage plants. The measurement of the product temperature for the temperature compensation has to be performed nearby the density measurement.

At the feeding of chamber filter press the pressure in the feeding pipeline depends by the filling degree of the chamber filter press. At an empty chamber filter press the pressure is very low. When the filling degree increases the pressure becomes higher. For reducing the error caused by gas bubbles at the beginning of the filling procedure, the digital "HALT"-input of the evaluation unit can be used. With it the measuring value can be "frozen". In the pipeline a pressure sensor with isolated contact is installed. The threshold is adjusted in a way that the contact at a pressure of i.e. more than 5 kp/cm<sup>2</sup> will be opened and releases the measuring procedure. If the pressure drops below the adjusted value the measuring procedure is stopped. After stopping the measuring value and also the current signal remain on the last value. The flocculent proportion is done according to the last measured solid content during this measuring break.