

# Flare Gas Flow Measurements



## The tracer concept for measurements under production conditions

The use of gaseous tracers permits efficient and reliable measurements of linear flow velocity of gas in flare systems under normal production conditions and covering the full range of flow rates.

A small amount of radioactive gas is injected into the flare gas stream, and the transit time for the tracer cloud between two radiation detectors outside the pipe is recorded. The linear velocity is determined from the distance between the detectors divided by the transit time.

The method is based upon the international standard ISO 4053 - Part IV: "Measurement of gas flow in closed conduits - transit time method using radioactive tracers."

Measurements during production can be used both

for control or calibration of permanently installed flow meters and for flow velocity assessment where no meters are installed.

## Experience

Ever since 1983, FORCE Technology carries out yearly measurements on all flare gas systems on Danish offshore platforms. Measurements have also been made on Danish and Norwegian onshore gas treatment facilities and oil refineries.

Recordings of pressure, temperature, and other parameters for calculation of mass flow rates are in general provided by the offshore operator himself or by flow meter producers in connection with the tracer flow velocity measurements.

## Measurements in practice

The gas tracer is injected from a specially developed, highly automated and explosion proof equipment through a simple valve over less than 0.1 second to ensure the best accuracy. The injection is the only operation demanding access to the gas system.

Highly sensitive detectors are mounted on the outside of the pipes at selected down-stream positions to measure radiation through the pipe wall from the tracer inside. Units for injection control, and for data registration and treatment can be located in remote safe areas.

The results of the velocity measurements are immediately available ensuring that a sufficiently large number of measurements can be made over a short period of time which minimizes losses of gas when measuring at elevated flow rates.

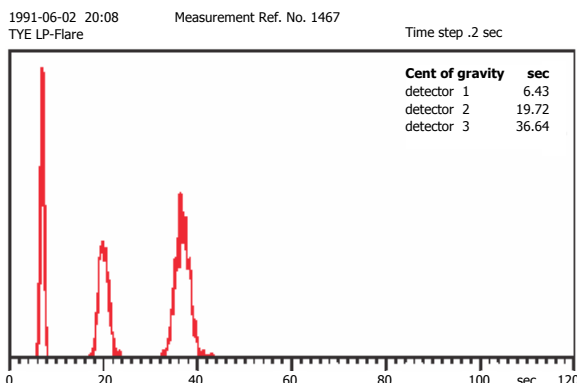
## Dynamic range and accuracy

Flow velocities ranging from a few centimetres/second to more than 100 metres/second are covered using the same instruments and set-up.

The accuracy obtained depends on practical possibilities for injection, the available length of measuring distances, and the stationarity of the flow. Under typical conditions and flow rates up to 50 metres/second, an accuracy better than  $\pm 1\%$  of actual flow velocity is obtained. At larger flows, the limit is set by the length of the measuring distance, and the accuracy is normally better than  $\pm 2\%$ .

Repeated measurements being feasible due to the efficiency of the method and the equipment, improve the overall accuracy.

Using three measuring positions, the stationarity of the flow velocity over the two measuring distances is controlled. That is of special importance in case of low velocities, where the variation in flow sets the limit for the accuracy to be obtained.



## Safety

The most commonly used gas tracer is the noble gas krypton as the Kr-85 isotope, which is chemically inactive. The amounts of isotope used cause no significant radiation exposure to platform personnel, and it is totally insignificant compared to the amount present in the global environment.

Transport and handling of radioactivity follow internationally accepted regulations under licence from National Radiation Health Authorities to FORCE Technology.



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